

# Parasite Fauna and Infection of Sheep with Parasitosis

<sup>1</sup>Assylbek Abdrashitovich Zhanabayev, <sup>2</sup>Birzhan Yeleubaevich Nurgaliev, <sup>2</sup>Abzal Kenesovich Kereyev, <sup>1</sup>Assel Yerzhanovna Paritova, <sup>1</sup>Altay Yegemberdievich Ussenbayev, <sup>2</sup>Svetlana Maksutovna Bayantassova, <sup>1</sup>Dinara Seitkamzina, <sup>2</sup>Guldari Kairshakovna Zhumagaliyeva and <sup>1</sup>Botakoz Yelemessova

<sup>1</sup>Faculty of Veterinary and Production Technology of Livestock, S. Seifullin Kazakh Agrotechnical Research University, Kazakhstan  
<sup>2</sup>Zhangir Khan West Kazakhstan Agrotechnical University, Kazakhstan

## Article history

Received: 21-04-2022

Revised: 12-08-2022

Accepted: 29-08-2022

## Corresponding Author:

Assel Yerzhanovna Paritova  
Faculty of Veterinary and  
Production Technology of  
Livestock, S. Seifullin Kazakh  
Agrotechnical Research  
University, Kazakhstan  
Email: Paritova87@mail.ru

**Abstract:** The purpose of our research was to study the parasitic fauna and infection of sheep with parasites in the northern and southern regions of the Republic of Kazakhstan. For this, we conducted a study to determine the species diversity of sheep parasites. The study was set from 2010-2020 years on infected sheep in the northern and southern parts of the Republic of Kazakhstan. The experiments were conducted at the Department of Veterinary Medicine of S. Seifullin KazATU and the KazNIVI in Almaty. The species diversity of parasites of adult sheep was studied. The materials for parasitological laboratory studies were sheep feces taken from 50 sheep. Vital diagnostics of helminthiasis were carried out by scatological studies of 50 sheep using the well-known methods of Fulleborn, Weid, and Boyahchyan. To establish the timing of infection, selective coprolarvoscopic studies of fecal samples taken from pastures were carried out. First, the invasive larvae were isolated from fecal samples by the Berman-Orlov method. Differential diagnosis of trichostrongylides was carried out according to the method of Y.Y. Shumakovich. Among the sheep of the Akmola and Karaganda regions, strongylatoses parasitizing in the gastrointestinal tract are recorded: Nematodyrosis, ostertagiosis, hemonhoz, marshallagiasis, esophagostomosis, and, less often, bunostomosis. The development of eggs and larvae of the invasive stage in pasture conditions is noted at the end of the first decade of May. The first cases of infection of lambs are observed in late May-early June. Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age.

**Keywords:** Invasive Larvae, Sheep Parasites, Species Diversity, Strongylatoses

## Introduction

Today, sheep breeding is one of the most important branches of the agro-industrial complex of Kazakhstan, which, in several cases, is the only source of obtaining the most important types of products: Wool, meat-button, fur, and fur sheepskins. But today one of the problems in the development of sheep breeding in the Republic of Kazakhstan is the high infection of sheep with parasitosis (Master Plan, 2013; Business Plan, 2021).

Parasites are an integral part of the biological diversity of natural ecosystems and are an indicator of the health status of their host populations (Boyahchyan *et al.*, 2016; Aitpaeva *et al.*, 2021). The scientific basis for the

conservation of biodiversity of various ecosystems is research on the inventory of fauna and parasitic complexes. In natural rangelands, where, as a rule, antiparasitic measures are not carried out, most domestic and wild animals become infected with parasitic diseases and permanently seed the external environment with the invasive principle (Suleimenov *et al.*, 2014; Ertaş *et al.*, 2022). Therefore, the study of the species diversity of parasites and the infection of animals with them is of great interest not only for parasitologists, zoologists, and ecologists but also for veterinary medicine specialists from the point of view of ensuring the parasitological safety of natural ecosystems and developing measures to combat diseases caused by parasites (Roerber *et al.*, 2013).

Helminthiasis in Kazakhstan have their own epizootological and epidemiological characteristics due to specific natural climatic and socio-economic conditions. The entire territory of the republic is favorable for the spread of various types of helminths and people are at high risk of contracting the main zoonoses (Cebra and Stang, 2008; Liddell *et al.*, 2020).

Parasitic nematodes (roundworms) of small ruminants and other livestock have major economic impacts worldwide. Despite the impact of the diseases caused by these nematodes and the discovery of new therapeutic agents (anthelmintics), there has been relatively limited progress in the development of practical molecular tools to study the epidemiology of these nematodes. Specific diagnosis underpins parasite control and the detection and monitoring of anthelmintic resistance in livestock parasites, presently a major concern around the world (Mohammadi *et al.*, 2022).

Sheep are distributed according to spatial variation in resources, such as forage (Moradpour *et al.*, 2018; Mandla *et al.*, 2022) and the suitability of environmental parameters (Juránková *et al.*, 2021). Their distribution can be further altered by other external factors such as predation and parasitism (Yeasmin *et al.*, 2014; Alade and Bwala, 2015).

The purpose of our research was to study the parasitic fauna and infection of sheep with parasites in the northern and southern regions of the Republic of Kazakhstan. For this, we conducted a study to determine the species diversity of sheep parasites.

## Materials and Methods

“The research was approved by the ethical commission of the Faculty of Veterinary Medicine and Livestock Technology of the N. S. Seifullin KATU (extract from minutes No. 1 dated January 11, 2010)”

The research was carried out from 2010-2020 years on sheep for the infestation in the northern and southern parts of the Republic of Kazakhstan. The experiments were carried out at the Department of Veterinary Medicine of S. Seifullin KazATU and the KazNIVI in Almaty. The species diversity of parasites of adult sheep was studied. The materials for parasitological laboratory studies were sheep feces taken from 50 sheep. The invasion of animals with endoparasites was determined by the method of *in vivo* diagnostics. Vital diagnostics of helminthiasis were carried out by scatological studies of 50 sheep using the well-known methods of Fulleborn, Weid, and Boyahchyan.

To establish the timing of infection, selective coprolarvoscopic studies of fecal samples taken from pastures were carried out. First, the invasive larvae were isolated from fecal samples by the Berman-Orlov method. Differential diagnosis of trichostrongylides was carried out according to the method of (Cebra and Stang, 2008; Liddell *et al.*, 2020).

## Fecal Egg Counts

Fecal samples were collected directly from the rectum of each animal during the experimental epidemiology (paper I) and the anthelmintic-resistance (papers III and IV) studies. The numbers of fecal nematode eggs were determined using a modified McMaster technique with saturated sodium chloride solution as the floating medium. In each case, 3 g of feces were mixed in 42 mL of saturated salt solution and the number of nematode eggs Per Gram of Faces (EPG) was obtained by multiplying the number of nematode eggs counted in two squares of the McMaster slide by a dilution factor of 50. The nematode eggs present were identified in general terms as strongylid eggs, since relevant nematode genera produce eggs that are similar in appearance and cannot be discriminated easily, except for the eggs of *Nematodirus*, *Strongyloides*, and *Trichuris* species (Cebra and Stang, 2008; Moradpour *et al.*, 2018; Mohammadi *et al.*, 2022).

## Fecal Cultures, Larval Identification and Enumeration

Duplicate composite fecal cultures, consisting of 2 g of feces from each animal, were done for each group of animals in the experimental epidemiology (paper I) and anthelmintic-resistance (papers III and IV) studies. The pooled fecal materials were incubated at room temperature (approximately 22–25°C) for 14 days and then the nematode larvae were harvested, identified to species level, and quantified according to Anon and (Cebra and Stang, 2008; Moradpour *et al.*, 2018; Mohammadi *et al.*, 2022). Where possible, 100 larvae were identified and counted for each experimental group of animals (Mandla *et al.*, 2022).

## Data Analyses

All of the parasitological and performance data (EPG, fecal culture larval counts, tracer, and abattoir post-mortem worm counts) were first entered into the Microsoft Excel program. The fixed effects of age and sex of animals, seasons, and years on EPG were analyzed with repeated measures analyses according to the SAS mixed procedures (Statistical Analysis System Institute, version 9.1, Cary, NC, USA).

## Results

In the conditions of Kazakhstan, in different regions, the sheep population is used for pastures at different times of the year. For example, if in the north of the republic until the second decade of April, the sheep-head of the private sector is kept indoors, then in the southern regions the grazing period begins in the second decade of March.

Therefore, the time of infection in the northern regions of Kazakhstan, in comparison with the southern regions, comes 1-1.5 months later.

When studying for the infestation of sheep in the Akmola and Karaganda regions in 2017, due to the lack of medical treatments, the initial infestation was almost at the same level.

But, regardless of the time of infection, the invaded animal is a source of pasture contamination with invasive elements, thereby posing a danger of infestation by helminthiasis of lambs of the current year of birth (Table 1). Thus, at the beginning of wintering in 2017, sheep in all agricultural formations and rural districts of the Akmola region were infected by almost 87% with trichostrongylidosis (Fig. 1) and 27.5% with monieziosis. Nematodyrosis was established in young animals up to 1.5 years old, in which the extensiveness of invasion was 33.4% (Fig. 2).

In a comparative aspect, high intensity of nematodiosis invasion was recorded in young animals up to one-year-old (14-78 ind.), while in young animals older than 1 year during the peak of invasion, up to 23 specimens were found in three drops of the sample.

In general, it should be noted that in young sheep, nematodiosis proceeded in a subacute form (most often, lambs died 7-9 days after the first clinical signs were discovered in them).

In the southern regions of Kazakhstan (according to research by KazNIVI employees), myx invasion was recorded on 2 farms in Zhambyl and South Kazstanskaya regions, where an average (3-24 specimens) invasion was noted in terms of intensity (Table 2).

At the same time, the eggs of moniesia were found in 27.5% of the sheep population, which pollute not only the near-koshar area but also the pasture, which in turn poses a danger of infection of lambs of the current year of birth by swallowing oribatid ticks infested with cysticeroids (Fig. 3).

Of the 68 sheep, 61 heads, or 89.7% are infected with strongylatosis (trichostrongylidosis), 30.8% with nematodiosis, and 39.7% with moniesiasis. Sheep, especially lambs of the current year of birth, who are in pasture conditions, are thin, weak, and profuse diarrhea is observed.

When examining fecal samples from sheep belonging to Otkanzhar LLP of the Nurinsky district of the Karaganda region, the following genera of helminths were identified to establish the helminth fauna (Table 3).

Based on the obtained coprolarvoscopic studies, it follows that the sheep of Koigeldy-Astykh LLP have the main trichostrongylids, which are characteristic of the sheep-head of the northern region of Kazakhstan, namely: *Ostertagia*, *nematodira*, *hemonchus*, and *trichostrongyla* (Fig. 4 and 5).

In terms of specific gravity, nematodiras, hemonchies, and ostertagias occupy dominant positions, their share in the total infection is 66-75%.

The other two types, i.e., *trichostrongyla* and *esophagostomas* were recorded less frequently than in the previous species.

In the spring-summer period, the timing of the development of eggs and invasive larvae of trichostrongylids in the environment under pasture conditions was studied (Table 4).

Thus, in the conditions of the pastures of the Akmola region, the development of eggs of trichostrongylids begins when a stable temperature (+14°C) occurs. The development and achievement of the larvae of the invasive stage are observed in the period of May 17-19.

The first cases of infection of lambs with trichostrongylidosis in two rural districts of the Akmola region were in late May and early June.

To draw up scientifically based measures according to the plan in the conditions of northern Kazakhstan, in 2019, relevant studies were continued.

We found that in this region of the republic during the autumn deworming, the infection of ruminants until the second decade of May is up to 3-5% of the total population. But, climatic changes in recent years usually introduce their adjustments, as in 2019, when the animals left the pasture 2-2.5 weeks earlier.

Therefore, the main livestock of sheep in the conditions of northern Kazakhstan, in particular in the Akmola region, are infected from the third decade of April and continues until the end of September inclusive. But, regardless of the time of infection, the infested animals are a source of contamination of pastures with invasive elements, thereby posing a danger of infestation by helminthiasis of lambs of the current year of birth.

As can be seen from Table 5, despite the spring-summer period of 2018, taking into account the fact that the winter of 2018-2019 in these regions was harsh and the spring was rather cool (sometimes down to minus 4-6°C), sheep in three agricultural formations and rural districts of Akmola oblast are infected with up to 80% strongylatosis.

Nematodyrosis, as in previous years, was established in 84 young animals up to 1.5 years of age, in which the extent of invasion was 25.7%. This disease was recorded in rural districts and LLPs, where they used the same pasture areas every year.

High intensity of invasion was recorded in sheep with strongylatosis (9-134 specimens), while in nematodyrosis, the intensity of invasion was up to 56 specimens, which indicates a rather long development of nematodynia eggs in the external environment than in other strongylates.

To establish biochemical changes in blood in sick and healthy animals, the following enzymes were compared: Aspartate Aminotransferase (AST), alanine Aminotransferase (ALT), Alkaline Phosphatase (ALP), which play the role of degrading coenzymes. It was found that ALT and AST in sheep suffering from helminthiasis are contained, respectively, by  $4.2 \pm 0.002$  katal and  $6.09 \pm 0.006$  katal, which is more than in healthy animals (deworming before the study). The activity of the enzymes ALP and GGT are also increased.

**Table 1:** Initial infection of sheep with helminthiases

Region, district, LLP	Number of heads	Extensiveness of invasion, %:		
		Trichostron-hylidosis	Nematodyrosis	Monieziosis
Akmola region				
Koigeldy-Astyk LLP	137	112/82,0	39/28,8	64/47,0
The private sector of the Prirechensky rural district	188	171/91,3	78/41,4	39/20,9
International r/d	92	74/80,6	24/26,7	11/12,8
Torgaysky r/d	127	118/93,6	46/36,6	37/29,1
Average EI	544	475/86,9	187/33,4	151/27,5
Karaganda region				
Otkanzhar LLP	68	61/89,7	21/30,8	27/39,7
Average EI	68	61/89,7	21/30,8	27/39,7

**Table 2:** Infection of sheep with helminthiases in the southern region of the republic

Region, district, LLP	Number of heads	Extensiveness of invasion, %:		
		Fascioliasis	Strongylatoses	Monieziosis
Jambyl Region				
Peasant farm "Baiterek"	50	12,0	78,0	26,0
Average EI	50	4-7	9-11	8-13
South Kazakhstan region				
Pleasant farm "Dikhanbai"	40	15,0	68,0	29,0
Average EI	40	11-21	6-24	3-18

**Table 3:** Fauna of sheep trichostrongylids in Koigeldy-Astyk LLP

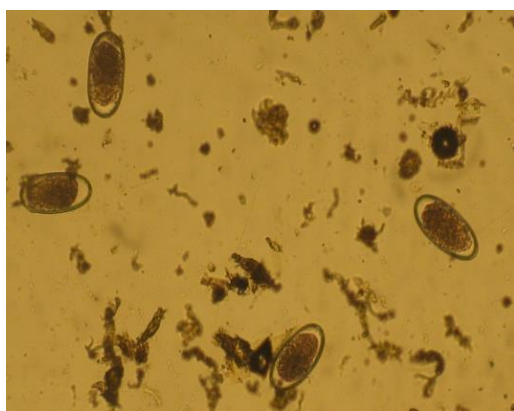
Fecal sample no.	Discovered types of trichostrongylids				
	Nematodiras	Ostertagius	Hemonchies	Trichostron-gilus	Esophagotoma
No. 1	16	12	24	2	1
No. 2	8	42	4	-	-
No. 3	27	-	19	-	-
No. 4	-	38	11	-	-
No. 5	12	-	16	-	13
No. 6	9	38	-	-	5
No. 7	-	47	-	-	-
No. 8	4	-	-	-	-
No. 9	23	-	7	3	-
No. 10	-	-	16	-	-
No. 11	-	11	2	9	-
No. 12	4	9	-	6	7
Intensity of invasion, copies	4-27	9-47	2-24	2-9	1-13

**Table 4:** Terms of development of invasive larvae of strongylates of the gastrointestinal tract in the external environment and the first cases of infection of lambs

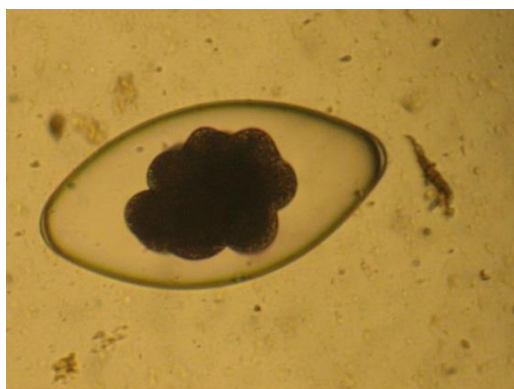
Research date	Formation of first stage larvae	The timing of the development of invasive larvae	The first cases of infection of lambs
15.04.18., 19.04.18., 22.04.18., 25.04.18., 29.04.18., 04.05.18., 12.05.18.	do not develop blastomere formation	Do not develop Not detected	not detected not detected
17.05.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>	Large number of L <sub>3</sub>	not detected
19.05.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>	Accumulation of Invasive Larvae (IL)	not detected
22.05.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>	7 samples contain from 12 to 63 larvae	not detected
27.05.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>	In three samples of larvae from 29 to 42 IL	Trichostrongylide eggs were found in 4 lambs
29.05.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>	IL of all 4 genera of trichostrongylides	found in 6 lambs
02.06.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>		found in 11 lambs
08.06.18.	found in all samples L <sub>1</sub> and L <sub>2</sub>		found in 17 lambs
P.S. L <sub>1</sub> , L <sub>2</sub> , and L <sub>3</sub> – respectively, invasive larvae of the 1 <sup>st</sup> , 2 <sup>nd</sup> , and 3 <sup>rd</sup> stages of development			

**Table 5:** Infection of sheep with helminthiases in the spring-summer period

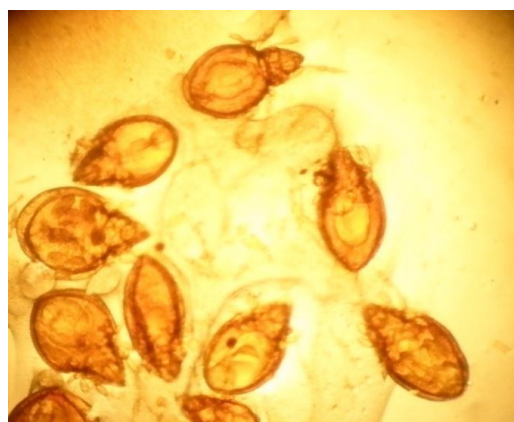
Region, district, LLP	Number of heads	Extensiveness of invasion, %:		
		Strongylatoses	Nematodyrosis	Monieziosis
Koigeldy-astyk LLP	192	147/76,6	39/20,3	16/8,30
Prirechensky rural district	81	68/83,9	28/34,6	29/35,8
Timofeevsky rural district	53	44/82,5	17/32,1	8/15,1
EI by region	326	259/79,4	84/25,7	53/16,3
II by region		9-134	3-560	4-310



**Fig. 1:** Discovered Trichostrongylid eggs in sick sheep



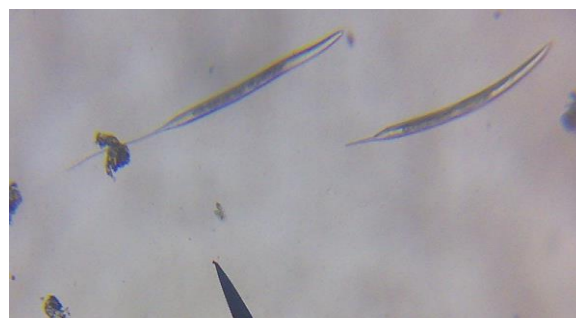
**Fig. 2:** Eggs of nematodes found in lambs in Koigeldy-Astyk LLP



**Fig. 3:** Oribatid mites infested with cysticercoids found in soil samples of the Torgai rural district



**Fig. 4:** Invasive nematode larva



**Fig. 5:** Detected invasive ostertagia larvae

An increase in the activity and an increase in the content of these enzymes in the blood serum are explained by the violation of protein and carbohydrate metabolism, which leads to the degeneration of liver cells during the migration of strongylate larvae.

When studying fresh grass (in the morning after dew) according to Berman-Orlov for the presence of strongylate larvae, we found invasive larvae of nematodir and ostertagia. Based on the coprolarvoscopic studies obtained, it should be noted that trichostrongylidosis are characteristic of sheep in the northern region of Kazakhstan.

In addition, in the climatic conditions of this area, the development of trichostrongylid eggs in the pasture reaches the invasive stage by May 17-20. Therefore, the intensity of infection of lambs with trichostrongylidosis in rural districts is observed at the end of May and in the first decade of June.

Monieziosis by the end of the spring period mainly affects older sheep. Of the investigated fecal samples, eggs of moniesia were observed in ewes and young animals in the last year of birth and amounted to 53 heads,

or 16.3%. This suggests that these animals were infected in the autumn of 2018. In general, the number of sheep infected with various helminthiasis in the first half of 2019 ranged from 16 to 76%, depending on the genus of the helminth.

When examining 623 sheep in the second half of 2019, we found that the infection rate is increasing (Table 6).

So, out of 623 sheep, 504 heads, or 87.7% are infected with strongylatosis, including 31.1% or 194 heads with nematodyrosis.

In the context of rural districts and agricultural formation in Koigeldy Astyk LLP and the Ulentinsky rural district, 91-96% of sheep are infected with strongylatosis, which indicates a high extent of the invasion. In two other rural districts, 61-81% of sheep are contaminated with strongylatosis.

Nematodyrosis was most often recorded among lambs of the current year of birth and in youngsters born in 2017 at the end of June-at the beginning of July 2018. So, in the investigated fecal samples in 25-38% of cases, from 9 to 86 eggs were noted, which indicates a high intensity of invasion. It should be noted that the total infection of sheep in 2010 was facilitated by the high ambient temperature and low air humidity, which reduces the development of eggs to a minimum (up to 3-5 days) in the middle of summer.

Monieziosis, as in 2017, was noted already in June-July 2018 with a coverage of 41-56% of sheep. But, among sheep in Koigeldy-Astyk LLP, as well as in Ulentinsky and Timofeevsky rural districts, the extent of invasion is 6-15% lower compared to infection in Zhantekinsky rural district (Fig. 6).

In addition, as it is known, the crowded keeping of sheep indoors (at high humidity and temperature) in winter, with delayed shearing at the beginning of the summer period, infestation with ectoparasites (sifunculates, lice-eaters-sheep's fleece) is often observed.

The ectoparasites identified by us not only disturbed the animals but led to the loss of live weight and wool. In the summer, in three economic entities, we examined 95 heads of sheep for infestation with ectoparasites (Table 7, Fig. 7).

During visual clinical examination, it was found that sheep fleece (*Melophagus ovinus*) and lice-eaters (*Bovicola caprae*) are most often recorded in sheep.

As can be seen from Table 7, the sheep population of 3 subjects (including those of the sheep belonging to the faculty of KazATU, despite the treatments carried out in April 2018) is infected with up to 86-87% of ectoparasites, mainly of two types.

Thus, the infection of sheep with helminthiasis and ectoparasitosis belonging to private farmsteads in rural districts and agricultural formations in 2018, due to the lack of planned treatment and prophylactic treatments on the part of animal owners and local leaders, remained high, as in previous years.

To obtain more accurate data on infection and to take adequate measures for treatment and prevention, additional studies were carried out in 2019.

In the conditions of Akmola oblast, the infestation of sheep by helminthiasis mainly occurs in the grazing period (from May to September), but in some years, when the autumn is warm, it can continue until mid-October and indoors.

As you know, according to the weather report service, the end of 2018 was characterized by relatively warm weather (the average temperature for October-November was minus 8-11.2°C and the stall keeping of animals, including sheep, moved only in the third decade of November.

In the majority of strongylates, the invasive larvae that had invaded the body at the end of September 2018 after a slight migration in the body (mainly the submucosa and sub-sera) and 3-4 weeks after the reverse migration in the intestinal lumen became sexually mature.

Therefore, in this region of the republic, in the period from November-December to January of the next year, the extensiveness of the invasion increased due to the autumn reinvasion (Table 8).

As can be seen from Table 10, the infestation of sheep in December-February of the last and the current year in only two rural districts is 93.9% with strongylatosis, 43.9% with nematodiosis, and 34.5% with moniesiasis. The high contamination with helminthiasis is explained by the constant grazing of animals in a limited area.

In addition, it should be noted that some owners of sheep, especially heavy-licking and lambing ewes, are kept in warm rooms, which leads to the re-infection of lambs of the current year from the moment of birth through litter, contaminated feed, etc.

A strong degree of invasion intensity can be observed by strongylatosis (from 12 to 128 ind.). Nematodyrosis, to which young animals under 1.5 years of age are more often exposed, also has an average intensity of invasion (9-42 eggs).

In the same period, among young animals, up to 1 year old, which were in the pasture in the summer of 2018, the eggs of moniesia were recorded in the amount of 26-49 specimens. We explain the high intensity of invasion in young animals by the joint keeping with adult sheep. At the same time, in adult ewes and breeder rams, the extensiveness of invasion ranges from 3 to 17-19 eggs, which indicates the phenomenon of carriers, which are sources of invasion for lambs and young animals.

The species composition of helminths in sheep from different regions is almost the same. So, for example, in cultured samples of sheep feces from the Korgalzhyn and Ereimentau districts, in the study using the Berman-Orlov method, invasive larvae of nematodir, hemonchus, ostertagia, and trichostrongil differed only in their quantitative composition (Table 9).

**Table 6:** Infection of sheep with helminthiases in the summer-autumn period of 2019

The region, district, LLP	Number of heads	Extensiveness of invasion, %:		
		Strongylatoses	Nematodyrosis	Monieziosis
Koigeldy-Astyk LLP	147	134/91,2	46/31,3	71/48,3
Ulentinsky r/d	136	131/96,3	51/38,9	61/44,9
Timofeevsky r/d	189	116/61,2	59/31,2	79/41,8
Zhantekinsky r/d	151	123/81,4	38/25,2	86/56,9
EI by region	623	504/87,4	194/31,1	297/47,6
II by region		11-960	9-860	14-380

**Table 7:** Infection of sheep with ectoparasites in the summer-autumn period

Rural district, district	Studied head	EI by ectoparasites %
1 Timofeevsky r/d	44	39/88,6
2 Koigeldy Astyk LLP	39	32/82,1
3 Faculty training sheep	12	11/91,7
Total	95	82/86,3

**Table 8:** Infection of sheep with helminthiases in the winter period of 2010-2011

Name of r/d, LLP	A NUMBER of heads	Extensiveness of invasion, %:		
		Strongylatoses	Strongylatoses	Strongylatoses
Zhantekinsky r/d	67	63/94,1	29/43,3	20/29,8
Ulentinsky r/d	81	76/93,8	36/44,4	31/38,3
EI, %	148	139/93,9	65/43,9	51/34,5
II, copies		12-128	9-42	3-48

**Table 9:** Species composition of strongylates of the gastrointestinal tract of sheep of the akmola region in the winter period of 2019

Name of r/d	Number of samples examined and age	II of invasive strongylate larvae:			
		Hemonchies	Nematodiras	Ostertagius	Trichostrongyla
Zhantekinsky	12 from adults	4-11	21-28	6-63	-
	9 from young	9-12	24-38	-	7-19
Sofievsky	16 from adults	2-18	18-51	19-109	4-58
	11 from young	23-41	22-58	4-9	1-27

**Table 10:** Infection with helminthiasis of sheep in the spring

Name of r/d, LLP	Number of heads	Extensiveness of invasion, %:		
		Strongylatoses	Strongylatoses	Strongylatoses
Village Kiima	47	16/84,2	10/52,6	5/26,3
Village Sofievka	69	48/71,1	21/28,9	21/29,0
EI, on average%	116	64/77,6	32/40,7	26/27,7
II, copies		76-113	26-310	9-410

As can be seen from Table 10, in three drops of sedimentary liquid in the winter period, invasive hemonchus larvae were found in adult sheep-2-18, nematodir-18-51, ostertagia-6-109 and trichostrongyl from 4 to 58 specimens, while in young animals 9-41, 22-58, 4-9 and 1-27, respectively. Our data show that in young sheep, compared with adults, three species of invasive larvae are higher in intensity, except for ostagia.

When examining samples of sheep feces by the Fülleborn method in the spring of 2019 in two rural districts (Kiiminsky and Sofievsky) located in the southwestern and northeastern parts of the Akmola region, we found that the extensiveness of the invasion, on average, was infected with strongylatoses 77.6% of the livestock. But, among these animals, in

addition, almost 41% were contaminated with nematodyrosis and 28% with moniesiasis (Table 10).

We also identified sexually mature moniesia during the autopsy of the 16 months old young animals that were forcedly killed in 3 heads.

By the end of the summer-pasture period (September), due to the positive temperature (8-13°C) of the environment in the agricultural formations of the Akmola region, where they are engaged in sheep breeding, the infection with helminthiases continued. In our opinion, this was facilitated by two main factors: Heavy rainfall and increased temperature this year, which ultimately led to the development of invasive larvae in the external environment.



**Fig. 6:** Young growth infected with monieziosis



**Fig. 7:** *Bovicola caprae* (left) and their accumulation in the coat of a coarse-haired sheep

To compare the autumn infection of sheep with helminthiasis, two groups were taken (deworming at the end of August using CLS and treated before going out to the pasture). So, when conducting scatological studies of sheep feces samples in 1 LLP and 2 rural districts of the Akmola region, the following parameters were established. In samples of feces from sheep belonging to LLP "DiOL", Sofievsky, which underwent medical treatments in the period of August 9-11, the infection was 17-21% with trichostrongylidosis, 4-5.5% with monieziosis, while in sheep of the Kirovsky rural district (Zhaksynsky district) processed only in April found trichostrongylid eggs in 73-91.2% and moniesia in 17-42.3% (Ibrayev and Zhanabayev, 2009; Suleimenov *et al.*, 2011).

When coprolarvoscopic studies in the samples by specific gravity, almost all were found: *Ostertagia* (34%), trichostrongil (31%), nematodir (16%), and hemonchies (19%).

Moniesiasis among lambs and young animals of the last year of birth (in 146 heads) in 2019 was noted with two peaks (with a large coverage of the livestock) on July 7-15 and August 21-26, which also confirms the onset of favorable conditions for the development of shell mites-oribatids.

During clinical examination and visual examination of the coat, ectoparasites were found in 47-62.4% (ixodid mites, lice of the malofagide and trichodectide families), which, as is known, develop at high humidity and ambient temperature.

In addition, the flight of the nasocaval gadfly-estrus during this period was observed until August 21 (usually in previous years, their flight ended at the end of July or until August 7).

Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age (Ibrayev *et al.*, 2009).

## Discussion

Sheep are very liable to attack by parasites, probably suffering more severely from cause than any other kind of livestock. The importance of parasites and parasitic diseases in sheep is more evident because sheep are but little subject to serious bacterial plagues or virus diseases (Alade and Bwala, 2015).

Endoparasitic infestations cost the livestock industry many millions of pounds each year through losses in productivity and the costs of control measures. Effective control of these endemic ubiquitous diseases is important, particularly given the expanding world population and the expectation of increasing demand for ruminant products (Ohiolei *et al.*, 2019; Mohammed and Kadir, 2020; Muku *et al.*, 2020).

The same investigation was carried out to determine the prevalence of arthropoda and helminth parasites in sheep at Azimpur, Dhaka from February 2012 to January 2013. A Total of 60 hosts were examined and about 71.67% of sheep were found to be infested with arthropod parasites. In sheep two species of arthropod parasites, *Linognathus vituli* (61.67%) and *Damalinea caprae* (68.33%) were identified as ecto-parasites. The prevalence of ectoparasites was higher during summer (85%), followed by winter (75%) and rainy (55%). The higher intensity was also recorded in summer ( $325.17 \pm 1.92$ ). Lambs were found more susceptible (85.71%) than adult (80.95%) and young (56%) sheep and higher in females (77.27%) than in males (68.42%). Twelve species of helminth parasites were identified, of them, 3 trematodes, 3 cestodes, and 6 nematodes, the highest prevalence was shown by *Strongyloides sp* (71.67%) and the lowest by *Dictyocaulus sp.* (3.33%); found comparatively higher in adults (85.71%) than in young (80%) and 28% in lambs. The male sheep were more susceptible (81.58%) to helminth infection than the female (72.73%). The prevalence of helminthes was found higher in the winter (95%) season. The value of the coefficient of correlation between the prevalence and intensity of infestation of ectoparasites and helminth parasites in sheep were 0.95 and 0.978 respectively. In both cases, these two variables differed significantly ( $P < 0.01$ ) (Yeasmin *et al.*, 2014).



In general, it should be noted that nematodiras, like many other strongylates, are mostly localized in the thin and thick sections of the gastrointestinal tract of sheep. If the hemonchi parasitize in the abomasum, then in the small intestines the representatives of the family are trichostrongylides, which include: Nematodiras, ostertagias, marshallagias, trichostrongyls. In the thick section, larger strongylids of the genus are localized: Bunostoma, esophagostoma, habertia, etc.

This study was conducted in Maiduguri, Nigeria to determine how Gastrointestinal parasite infestation was affected by sex, season, age, and body weight and their relationship with hemoglobin concentration in Yankasa sheep. A total of 135 fecal and 135 blood samples were collected in each of the two seasons (dry and raining) of the year 2014, from the University of Maiduguri Livestock teaching and Research Farm, University of Maiduguri Veterinary Large Animal Clinic, and the Maiduguri Abattoir. The fecal samples were analyzed for gastrointestinal parasite eggs and the Haemoglobin concentration of the blood sample was analyzed. The gastrointestinal parasite egg count was estimated using the Modified McMaster technique and the hemoglobin concentration was determined using the cyanmethaemoglobin method. Five species of gastrointestinal parasite eggs discovered were; *Strongyle*, *Strongloides*, *Coccidian occyst*, *Moniezia*, and *Trichuris* with mean counts of 1080, 320, 1208, 30.2, and 1.60, respectively. There were significant differences ( $P < 0.05$ ) between the mean gastrointestinal parasite egg counts among animals of different sexes, age groups, body weight groups, blood hemoglobin concentrations, and in different seasons of the year. Females (3631/67.3%) had higher overall mean parasites egg counts and prevalence than the males (1747/53.4%), and the rainy season (2959/67.4%) was higher than the dry season (2559/53.3%). Age-wise, suckling animals (3286/68.3%) were more infected than the young (2999/59.3%) and adults (1993/53.5%). The group 06-31 kg had the highest overall mean egg count and prevalence (3151/68.8%) than the other groups 32-57 kg (1812/62.4%) and 58-81 kg (1125/49.7%). The group with a hemoglobin concentration of 5.7-8.3 g/dL had the highest overall mean parasitic egg counts of 3468 (67.9%) than those of the groups of 8.4-11.3 and 11.4-14.3 g/dL having 2837 (59.5%) and 1988 (53.7%), respectively; an indication that blood hemoglobin concentration and parasites egg counts were negatively correlated (Alade and Bwala, 2015).

Per-rectal fecal samples from sheep and goats were collected from Quetta and Kalat (Kovak and Zarchi valleys) areas of Balochistan to assess endoparasitism. The qualitative examination showed an 87.7 (50/57)

percent prevalence of endoparasites. Nematodirus spathiger was the most prevalent species followed by Trichuris globulosa, Marshallagia marshalli, and Strongyloides papillosa. A considerable segment of small ruminants in these areas has mixed infection. The average number of Eggs Per Gram of feces (EPG) ranged from 291-546. The infected animals were dull, depressed, weak, and poorly conditioned (Rafique *et al.*, 1997).

## Conclusion

Among the sheep of the Akmola and Karaganda regions, strongylatoses parasitizing in the gastrointestinal tract are recorded: Nematodyrosis, ostertagiosis, hemonhoz, marshallagiasis, esophagostomosis, and, less often, bunostomosis. The development of eggs and larvae of the invasive stage in pasture conditions is noted at the end of the first decade of May. The first cases of infection of lambs are observed in late May - early June.

Thus, based on the three-year results obtained, it can be concluded that the absence of antiparasitic measures leads to infection of almost all livestock within 5-7 months and in subsequent years, reinfection occurs, which ultimately causes a decrease in productivity and increase mortality, especially among young animals up to 1.5 years of age.

The study of the parasitic fauna of sheep will help to develop instructions and measures to reduce infection of parasites during sheep grazing, taking into account the climatic characteristics of various regions of Kazakhstan.

## Author's Contributions

All authors equally contributed to this study.

## Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues are involved.

## References

- Aitpaeva, Z. S., Tagaev, O. O., Smagulov, D. B., & Davletova, A. M. (2021). Pasture prevention of intestinal invasions of sheep in the Caspian lowland. *Effective animal husbandry*, 2, 100-103. <https://www.agroyug.ru/magazine/pdf-mailing/ehffektivnoe-zhivotnovodstvo-2-168-mart-2021.pdf>
- Alade, N. K., & Bwala, M. D. (2015). Gastrointestinal-parasites infestation in Yankasa sheep in a semi-arid environment. *Livestock Research for Rural Development*, 27(6). <http://www.lrrd.cipav.org.co/lrrd27/6/alad27106.html>

- Boyahchyan, G. A., Movsesyan, S. O., Arutyunova, L. D., Petrosyan, R. A., Chubaryan, F. A., & Nikogosyan, M. A. (2016). Recommendations for the struggle against protostrongyloses in sheep and goats in Armenia. *Russian Journal of Parasitology*, *36*(2), 265-270. <https://doi.org/10.12737/20072>
- Business Plan. (2021). Sheep Farm Expansion, 2021. Nur-Sultan, pp: 4.
- Cebra, C. K., & Stang, B. V. (2008). Comparison of methods to detect gastrointestinal parasites in llamas and alpacas. *Journal of the American Veterinary Medical Association*, *232*(5), 733-741. <http://dx.doi.org/10.2460/javma.232.5.733>
- Ertaş, F., Karakuş, A. S., & Ayan, A. (2022). The Prevalence of Commonly Encountered Parasites in Sheep in Iğdir Province, Turkey. *Turkish Journal of Agriculture-Food Science and Technology*, *10*(2), 260-262. <https://doi.org/10.24925/turjaf.v10i2.260-262.4662>
- Ibrayev, B. K., & Zhanabayev, A.A. (2009). Method for fixation of helminthological material used during research in parasitology involves utilizing the same type of fixation solution by taking a solution of carbolic acid as a fixator of helminthological material. Patent number: KZ21291-A4. Patent owner: Saken Seyfullin Kazakh Agricultural University.
- Ibrayev, B. K., Zhanabayev, A. A., Bushmanov, P. G., & Mukanov, T. S. (2009). Method for preparing feed medicinal granules for horse treatment in case of helminthiasis involves taking anthelmintic preparation such as fenbendazole, wheat, and barley followed by mixing and delivering to granulator through the separator. Patent number: KZ21292-A4. Patent owner: Saken Seyfullin Kazakh Agricultural University.
- Juránková, J., Hulva, P., Bolfíková, B. Č., Hrazdilová, K., Frgelecová, L., Daněk, O., & Modrý, D. (2021). Identification of tapeworm species in genetically characterised grey wolves recolonising central Europe. *Acta Parasitologica*, *66*(3), 1063-1067. <https://doi.org/10.1007/s11686-020-00327-7>
- Liddell, C., Morgan, E. R., Bull, K., & Ioannou, C. C. (2020). Response to resources and parasites depends on the health status of extensively grazed sheep. *Proceedings of the Royal Society B*, *287*(1920), 20192905. <https://doi.org/10.6084/m9.figshare.c.4824699.v1>
- Mandla, D., Singla, N., Brar, S. K., & Singla, L. D. (2022). Diversity, prevalence, and risk assessment of nematode parasites in *Tatera indica* found in Punjab state. *Indian Journal of Animal Research*, *56*(6), 736-741. <https://www.arccjournals.com/journal/indian-journal-of-animal-research/B-4369>
- Master Plan. (2013). Development of sheep breeding in Kazakhstan until 2020, 2013. Astana, pp, 3. <https://file.fic.kz/store/2020/02/19/15821067040.pdf>
- Mohammadi, A., Bozorgomid, A., Sedaghat, M. M., Mowlavi, G., Abai, M. R., & Mostafavi, E. (2022). Assessment of the Endoparasite Fauna amongst the Rodents in Kurdistan Province, west of Iran. *Iranian Journal of Parasitology*, *17*(1), 70-78. <http://dx.doi.org/10.18502/ijpa.v17i1.9018>
- Mohammed, A. A., & Kadir, M. A. (2020). Estimation of some biochemical parameters and trace elements in sheep infested with *Taenia hydatigena* cysts in Sulaymaniyah province/Iraq. *Iraqi Journal of Veterinary Sciences*, *34*(1), 39-44. <https://doi.org/10.33899/ijvs.2019.125543.1065>
- Moradpour, N., Borji, H., Darvish, J., Moshaverinia, A., & Mahmoudi, A. (2018). Rodents helminth parasites in a different region of Iran. *Iranian Journal of Parasitology*, *13*(2), 275. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068363/>
- Muku, R. J., Yan, H. B., Ohiolei, J. A., Saaid, A. A., Ahmed, S., Jia, W. Z., & Fu, B. Q. (2020). Molecular identification of *Taenia hydatigena* from sheep in Khartoum, Sudan. *The Korean Journal of Parasitology*, *58*(1), 93. <https://doi.org/10.3347/kjp.2020.58.1.93>
- Ohiolei, J. A., Luka, J., Zhu, G. Q., Yan, H. B., Li, L., Magaji, A. A., ... & Jia, W. Z. (2019). First molecular description, phylogeny, and genetic variation of *Taenia hydatigena* from Nigerian sheep and goats based on three mitochondrial genes. *Parasites & Vectors*, *12*(1), 1-11. <https://doi.org/10.1186/s13071-019-3780-5>
- Rafique, S., Qudoos, A., Sattar, A., & Hayat, C. S. (1997). Parasitic infection of sheep and goats in Quetta and Kalat areas of Balochistan. *Pakistan Veterinary Journal*, *17*, 94-96. [http://www.pvj.com.pk/pdf-files/17\\_2/94-96.pdf](http://www.pvj.com.pk/pdf-files/17_2/94-96.pdf)
- Roeber, F., Jex, A. R., & Gasser, R. B. (2013). Impact of gastrointestinal parasitic nematodes of sheep and the role of advanced molecular tools for exploring epidemiology and drug resistance-an Australian perspective. *Parasites & Vectors*, *6*(1), 1-13. <https://doi.org/10.1186/1756-3305-6-153>
- Suleimenov, M. Z., Abdybekova, A. M., Tlepov, A. A., Tuganbaev, A., & Dzhuspubekova, N. M. (2014). Distribution of pathogens of parasitic zoonoses in Kazakhstan. *Teoriya i Praktika Parazitarnykh Bolezney Zhivotnykh*, *2*, 296-297.

Suleimenov, M. Z., Ibrayev, B. K., Zhanabayev, A. A., & Abdibaeva, A. A. (2011). Feed medicated mixture used for prevention and treatment of helminthiasis of small cattle, comprises wheat, barley, sunflower cake, feed chalk, triphosphate, dietary salt, premix, alben, and offals. Patent number: KZ25225-A4. *Patent owner: Kazakh Scientific Research Veterinary Institute.*

Yeasmin, T., Khanum, H., & Zaman, R. F. (2014). Seasonal prevalence of arthropoda and helminth parasites in sheep (*Ovis aries*). *Bangladesh Journal of Zoology*, 42(1), 45-55.  
<https://doi.org/10.3329/bjz.v42i1.23335>