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Prevalence of Endo and Ectoparasitism of Sheep in Northern Kazakhstan

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Abstract: Invasive diseases of sheep are widespread worldwide, including in Kazakhstan. Recently, in the Akmola farms of Kazakhstan, there has been an increase in the spread of gastrointestinal diseases in sheep. The study aimed to assess the Prevalence (P) of sheep parasitosis in Northern Kazakhstan to develop effective prevention and control measures. Five-hundred and sixty-four sheep were studied in four rural districts and three economic entities located on the territory of the Tselinograd district of the Akmola for the presence of Ecto and endoparasites. The most frequent parasites were *Nematoda* such as *Trichostrongylidae* spp., *Nematodirus* spp., *Skrjabinema ovis, Cestoda* such as *Moniezia* spp., protozoa such as *Eimeria* spp., arthropods such as *Melophagus ovinus, Bovicolaovis and Dermacentor and Wohlfarthia magnifica* larvae. The P of *Trichostrongylidae* spp., *Moniezia* spp., *Eimeria* spp., *Melophagus ovinus, Bovicola ovis, Dermacentor, and Wohlfarthia magnifica* in small cattle of the study area were 77.1, 23.0, 55.4, 50.5, 62.6, 34.3 and 13.1%, respectively. For the first time, *Skrjabinema ovis* with P = 3.1% and an intensity of 150±22 eggs/g and *Trichuris ovis* with P = 4.7% and an intensity of 350±23 eggs/g were recorded in sheep in the Akmola region. For the successful development of industrial sheep breeding, as well as optimal animal husbandry in individual farms, it is necessary to provide animals with high-quality feed and maintenance, as well as take measures to reduce infectious and invasive diseases.

Keywords: Gastrointestinal Diseases, Infestation Intensity, Prevalence, Sheep Parasitocenoses

Introduction

Sheep breeding is an important branch of animal husbandry, the products of which are widely used in the national economy. For optimal sheep rearing, it is necessary not only to provide animals with high-quality feed that meets veterinary and sanitary requirements but also to prevent infectious and invasive diseases. Among the small cattle pathologies, invasive diseases occupy one of the leading places (Myrzhieva *et al*., 2020; Pinilla León *et al*., 2019; Suleimenov *et al*., 2022).

As for sheep, the economic damage consists of the loss of live weight, lagging in the growth and development of young animals, reducing the yield and quality of wool, and reducing reproduction. Lambs under one year (68.2%) and animals of 1-2 years (48.8%) are more infested, while adults (29.1%) are less infested. Intensive infestation of animals usually occurs in spring and summer due to the accumulation of a large number of invasive larvae in pastures (Morgan *et al*., 2006).

Parasitocenoses concerning age and seasons were studied in many geographical areas such as Kazakhstan, Brazil, Western Pomerania, Poland, Germany, and Australia.

Carneiro *et al*. (2022) recorded 22 species of parasites in sheep in Brazil: Protozoan (*Eimeria faurei, E. intracata, E. ovina, E. ovinoidalis, E. parva, and Sarcocystis ovicanis*), trematodes (*Fasciola hepatica, Dicrocoelium lanceatum, Eurytrema pancreaticum, and Hastilesia ovis*), cestodes (*Moniezia expansa* and *M. benedeni*) and nematodes (*Trichostrongylus axei, Ostertagiella circumcincta, O. trifida, O. trifurcata, Marshallagia marshalli, Haemonchus contortus, Nematodirus oiratianus, N. spathiger, Strongyloides papillosus* and *Trichocephalus skrjabini)*.

Parasitocenoses in sheep in the mountainous of the Turkestan were studied by Asanova who determined the seasonal and age dynamics of five species of eimeria (*E. faurei, E. intracata, E. ovina, E. ovinoidali* and *E. parva*) and one species of strongyloids (*S. papillosus*). *Eimeria* and *Strongyloids* in the animals' bodies occur as mono and mixed infestations depending on the age and season of the year (Asanova *et al*., 2022). According to Rose *et al*., (2020), *Marshallagia, Nematodirus, Haemonchus, and Trichostrongylus* are the dominant genera of helminths in Kazakhstan. The number of fecal eggs was low (0-115 eggs per g) and there was no relationship between the density of fecal eggs and the assessment of fatness. Eggs of *Nematodirus spp*. were more common in sheep under one year, whereas *Trichostrongylids* were more common in adult sheep (Rose *et al*., 2020). Abdybekova *et al*., (2017) established the risks of parasitosis from wild animals. During their study, six nematodes: *Bunostomum phlebotomum, Capillaria bovis, Haemonchus contortus, Nematodirus spathiger, Oesophagostomum venulosum*, and *Trichuris skrjabini*, two cestodes: *Moniezia benedeni* and *M. expansa* and three coccidia were found: *Eimeria Cervi, E. gallivalerioi* and *E. robustus* (Abdybekova *et al*., 2017).

Marshallagia, Nematodirus, Haemonchus, and *Trichostrongylus* are registered among the sheep of the Akmola and Karaganda regions. The development of eggs and larvae in pasture is noted at the end of the first ten days of May. The first cases of lamb infestation were observed in late May to early June (Ibrayev and Zhanabayev, 2009; Zhanabayev *et al*., 2022).

The infestation prevalence with gastrointestinal parasites in the Western Pomerania region in sheep equals 100%. They revealed *Eimeria protozoa* and *Moniezia* spp., in sheep (Juszczak *et al*., 2019).

The annual dynamics of gastrointestinal nematodes in breeding sheep of the Silesian foothills in southern Poland consisted of *Trichostrongylidae (Trichostrongylus* spp., *Ostertagia* spp., *Nematodirus* spp., *Cooperia* spp., and *Haemonchus contortus); Strongylidae* (*Oesophagostomum* species, *Strongyloides papillosus* and *Chabertia ovina*) and *Ancylostomatidae* (*Bunostomum* species). Three nematodes dominated the parasitic infestation: *Trichostrongylus* (59.2%) *Ostertagia* (46%) and *Nematodirus*. The prevalence of sheep infestation with gastrointestinal nematodes was almost 100% (Balicka-Ramisz *et al*., 2013).

Coccidia was found in the feces of 556 of 592 sheep (93.9%) in Kars province. The prevalence of coccidiosis was significantly higher in young (97.9%) than in adult sheep (90.2%) (Arslan *et al*., 1999).

In the north-west of Germany, *E. bakuensis, E. ovinoidalis, E. weybridgensis/crandallis, E. parva and E. ahsata* species were most common *and E. faurei, E. granulosa, E. intracata and E. pallida* were less common (O'Callaghan *et al*., 1987; Barutzki *et al*., 1990).

The small cattle infestation with gastrointestinal nematodes in the Tselinograd district of the Akmola region was 20% higher, while the prevalence of coccidiosis in sheep was 10% lower compared to other studies.

The detected coccidiosis of sheep in South Australia was *E. crandallis/E. weybridgensis* (76), *E. ovina* (55), *E. ovinoidalis* (54), *E. granulosa* (49), *E. parva/E. pallida* (44), *E. intracata* (37), *E. ahsata* (31), *E. faurei* (24) and *E. punctata* (1%) (Sertse and Wossene, 2007).

The study of associations and parasitocenoses in small cattle is important for the organization of therapeutic and preventive measures and for reducing economic losses. The achievement of these goals largely depends on the well-being of farms concerning invasion diseases, which very often occur in the form of mixed diseases and cause even greater damage to sheep breeding (Zhanabayev *et al*., 2022). Several diseases caused by two or more pathogens are often not taken into account in practical conditions (Juszczak *et al*., 2019; Zhanabayev *et al*., 2022). The role of associative diseases and parasitocenoses in animal husbandry should be carefully studied, which will help to develop a systematic plan for their control.

Diagnostic tests for helminthiasis, protozoal, and arachnoentomoses are one important stage in the preventive and health measures (Garedaghi *et al*., 2022; Jaimes-Dueñez *et al*., 2022; Ualiyeva *et al*., 2022). The effectiveness of animal recovery from parasitosis depends on the precise determination of the species of parasites.

The study aimed to assess the prevalence of Ecto and endoparasites in sheep in Northern Kazakhstan.

Materials and Methods

Ethical Approval

The plan of the experiment and the treatment of animals within the framework of the study was approved and discussed at a meeting of the local ethical committee of the Saken Seifullin Kazakh Agrotechnical University on September 17, 2017 (protocol no. 2).

Place and Period

The study was carried out in the Tselinograd district of the Akmola and the parasitological laboratory named after N.T. Kadyrov at the Department of Veterinary Medicine of the Kazakh Agrotechnical University named after S. Seifullin in 2021-2022.

Samples

Eight-hundred and ninety-eight samples of sheep fecal masses from private farmsteads of the Rural Districts (RD) Koyandy (n = 115), Kyzyltu (n = 147), and

Sofiyevka (n = 135), Internationally village (n = 130), Gesser LLP (n = 127), Aymar Individual Entrepreneur (IE) (n = 125) and the farms of Zerendy LLP (n = 119) were examined for intestinal parasitosis.

Animals of the same farms were selectively examined for ectoparasites by their presence on the skin. Thus, a total of 564 sheep were thoroughly examined for ectoparasitism, among which, the RDs Koyandy (n = 87), Kyzyltu (n = 94), and Sofiyevka (n = 68), Internationally village (n = 65), Gesser LLP (n = 75), Aymar IE (n = 90) and the farms of Zerendy LLP (n = 85).

Methods

Fresh and glycerin-fixed fecal samples were examined using the McMaster method (https://www.rvc.ac.uk/review/parasitology/eggcount/Principle.htm) and the Fulleborn flotation method in the Professor N.T. Kadyrov parasitological laboratory at the Kazakh Agrotechnical University (S. Seifullin). The fixation was carried out using carbol fuchsin (Ibrayev and Zhanabayev, 2009). The slides were examined using an Olympus CX 23 microscope (Olympus, Japan) at magnifications of ×40, ×100 and ×400. The degree of infestation of animals was assessed by the prevalence of ecto and endoparasites in % and the intensity of infestation (II) by the Number of Eggs per Gram of feces (NEG). To determine the presence of ectoparasites in the same animals, the skin and wool were examined visually and with a magnifying glass.

Statistical Analysis

Statistical processing was carried out by the method of variation statistics using applied computer programs Microsoft Excel 2007 and STATISTICA 10.

Results

We identified the following parasite species belonging to the *Nematoda*, Suborder (S) *Strongylata*, Family (F) *Trichostrongylidae* spp., *Skrjabinema ovis* S: *Oxyurata*, F: *Syphaciidae; Trichuris ovis* Genus (G) *Trichocephalus*, F: *Trichocephalidae;* Class (C) *Cestoda: Moniezia* spp., S: *Anoplocephalata*, F: *Anoplocephalidae*; *Eimeria* spp. and Order (O) *Coccidiida* F: *Eimeriidae*.

The pathogens of *Melophagus ovinus* of O: *Diptera*, F: *Hippoboscidae; Bovicola ovis* of O: *Mallophaga*, F: *Trichodectidae; Wohlfarthia magnifica*, F: *Sarcophagidae; Dermocentor* of O: *Parasitiformes* of F: *Ixodoidea* were identified.

As revealed in Table 1, we saw that the small cattle were maximally infested with helminths from the F: *Trichostrongylidae* spp., while in the Sofiyevka RD, Gesser LLP, and Koyanda RD, the infestation rate was 89.6, 84.2, and 82.6%, respectively, with a minimum of 1100±98 and the maximum 1400±120 NEG. The smallest number of infested animals with Strongylatoses was detected in the farm of Zerendy LLP.

When examining the fecal masses of sheep in two farms of Gesser LLP and Sofiyevka RD, we identified eggs of *Skrjabinema ovis*.

Moniezia spp. were found in all the studied farms of the Tselinograd district and infestation of sheep with Trichocephalosis was also observed in the Koyandy RD and Sofiyevka.

Eimeria was found in animals of all the farms studied, with the maximum infestation in Zerenda LLP.

In the study of 564 heads of small cattle for ectoparasites (Table 2), in all farms, we identified melophagosis from 36.4% in Zerenda LLP to 78.9% in Aymar IE with varying II from 1 to 35 specimens.

Bovicola ovis was detected in 41.6% of the surveyed livestock with P 58.6% in the Prirechnoye RD and 25.3% in Gesser LLP.

Larval forms of Wohlfarthia magnifica were found in 10.8% of sheep during the summer pasture period but not in Aymar IE and Zerenda LLP.

Parasitiform ticks from the G: *Dermacentor* spp. were also found on sheep, while the sheep of Zerenda LLP were free of these arthropods.

Table 1: Infestation of sheep of Akmola region with endoparasites

		Detected Endoparasites														
		Trichostrongylidae spp.			*Skrjabinema ovis*			*Skrjabinema ovis*			*Trichuris ovis*			*Eimeria* spp.		
Farms	Number of studied samples	Positive positive	Prevalence, %	II, eggs /g	Positive samples	Prevalence, %	II, eggs /g	Positive samples	Prevalence, %	II, eggs /g	Positive samples	Prevalence, %	II, eggs /g	Positive samples	Prevalence %	II, oocyst /g
Koyandy RD	115	95	82.6	1,400±120	0	0	-	12	10.4	250±48	23	20.0	350±32	62	53.9	800±83
Kyzyltu RD	147	113	76.8	1,350±118	0	0	-	18	12.2	150±15	0	0	-	83	56.4	650±45
Sofiyevka RD	135	121	89.6	1,250±105	16	11.8	150±23	29	21.5	300±34	19	14.1	150±23	71	52.6	1,150±103
Gesser LLP	127	107	84.2	1,100±98	12	9.4	150±20	41	32.3	250±28	0	0	-	55	43.3	1,250±105
Aymar IE	125	96	76.8	1,150±103	0	0	-	33	26.4	650±45	0	0	-	78	62.4	950±89
Internat-sionalny village	130	94	72.3	1,350±125	0	0	-	64	49.2	800±83	0	0	-	87	66.9	1,450±125
Zerenda LLP	119	66	55.4	450± 36	0	0	-	10	8.4	150±23	0	0	-	92	77.3	1,350±118
Total	898	692	77.1	1,100± 98	28	3.1	150±22	207	23	350±38	42	47	350±22	498	55.4	1,150±102

Table 2: The infestation of sheep of Akmola region with ectoparasites

		Detected Ectoparasites											
		Melophagus ovinus			*Bovicola ovis*			*Wohlfarthia magnifica*			*Dermocentor spp.*		
Farm	Number of studied heads	Number of affected heds	Prevalence, %	II, Specimens	Number of affected heads	Prevalence, %	II, specimens	Number of studied %	Prevalence, %	II Specimens	Number of affected heads	Prevalence, %	II, specimens
Koyandy RD	87	62	71.2	2-17	51	58.6	11-21	18	20.7	10-23	55	63.2	2-7
Kyzyltu RD	94	73	77.6	1-20	49	52.1	11-85	11	11.7	3-17	38	40.4	1-5
Sofiyevka RD	68	41	60.3	3-35	31	45.6	5-30	18	26.4	5-20	29	42.6	3-10
Gesser LLP	75	46	61.3	1-18	19	25.3	5-24	8	10.6	10-47	41	54.6	1-7
Aymar IE	90	71	78.9	5-25	34	37.7	4-48	-	0	-	52	57.7	3-8
Internatsionalny village	65	44	67.7	3-20	29	44.6	5-55	6	9.2	3-10	23	35.3	2-8
Zerenda LLP	85	31	36.4	1-5	22	25.8	6-30	-	0	-	-	0-	
Total	564	368	65.2	1-35	235	41.6	5-85	61	10.8	3-47	238	42.2	1-10

Discussion

In the Tselinograd district of the Akmola region, animals spontaneously become infested with roundworms and tapeworms, coccidia and arachnoentomoses, which are represented by O: *Strongylata, Skrjabinema ovis*, *Trichuris* ovis, *Moniezia* spp., *Eimeria* spp., *Melophagus ovinus*, *Bovicola ovis*, *Wohlfarthia magnifica* and *Dermacentor*.

According to the data obtained, in the Tselinograd district of the Akmola region, the parasitocenosis of small cattle is represented by several species of the *Nematoda*, *Cestoda*, protozoa of the *Coccidiida*, entomoses of the *Diptera*, *Mallophaga*, flies of the *Sarcophagidae* and parasitiform ticks of the *Ixodoidea*.

Trichostrongylidae and coccidia are considered the most common endoparasites of small cattle. The infestation of animals most often occurs in pastures (Morgan *et al*., 2006). In our studies, *Trichostrongylidae* spp. eggs were found in all farms with II of 1,100±98 eggs per gram of feces, which indicates a high intensity of livestock infestation, with an II of 77.1% which corresponds to the research of P.R. *Torgenson*, M.Zh. Suleimenov, O.B. Berkinbay, B.B. Omarov, E. Baymukhanbetov and G.N. Asanova (68.2%). These data have been confirmed by Asanova *et al*., (2022); Morgan *et al*., (2006); Suleimenov *et al*., (2022).

The causes of infestation of small cattle with *Eimeria* spp., *Melophagus ovinus*, and *Bovicola ovis* according to (Zhanabayev *et al*., 2022) are primarily associated with poor conditions such as dirty, raw sheds, insufficient vitamin and mineral supplements, as well as crowded housing. The presence of these parasitoses was observed to a greater extent in young animals in the winter compared with adults in the summer (Zhanabayev *et al*., 2022).

According to Juszczak *et al*., (2019); Balicka-Ramisz, (2013), animals become infested with *Moniezia* spp. and *Dermacentor* spp. during the pasture period in the surveyed territories and the prevalence corresponds to this pattern when studying the seasonal spread.

For the first time in the Russian Federation, the sheep Scriabinemosis, *Skrjabinema ovis*, was registered in the Altai Territory. In 2019, *S. ovis*, Skrjabin, 1915 and *Trichuris* ovis, Abildgaard, 1795 were found in various regions in indoor small cattle (Efremova and Udaltsov, 2019).

In our studies, these pathogens with a minimum prevalence of 3.1 and 4.7, respectively, were discovered for the first time. To obtain more reliable indicators of the prevalence and II, it is necessary to use other, more accurate methods of *in vivo* diagnostics (an adhesive tape for *Skrjabinema ovis* and denser flotation solutions relative to *Trichuris ovis* eggs) (Efremova and Udaltsov, 2019; Modabbernia *et al*., 2021).

The infestation with Wohlfarthiosis of sheep was also manifested in the summer (10.8%) in the presence of swarming *Wohlfarthia magnifica* and mainly after the shearing of the animals causing wounds of mechanical causes (Jia *et al*., 2022; Remesar *et al*., 2022).

Zhanabayev *et al*. (2022) showed that the infestation of sheep with the main gastrointestinal helminthiasis and ectoparasitosis in young animals is higher than in adults, which is explained by acquired immunity after recovery in adults. The selective infestation, depending on the age, is explained by the increased sensitivity of individual age to certain parasitoses and the biology of the parasites themselves. In addition, the development and dynamics of sheep parasitosis also depend on the season. The results concerning the infestation of sheep showed that the peak of infestation with helminthiasis, Wohlfarthiosis, and the Ixodic tick was noted during the summer (Zhanabayev *et al*., 2022).

Among the pathologies of small cattle, infestations occupy a special place, which is confirmed by the data of researchers (Morgan *et al*., 2006; Abdybekova *et al*., 2017; Suleimenov *et al*., 2022; Zhanabayev *et al*., 2022). Success in invasive disease control depends on timely diagnosis, as well as the use of highly effective medications against different groups of parasites (Suleymenov *et al*., 2011a-b). For the treatment and prevention of helminthiasis in sheep, we offer highly effective feed medicinal mixtures containing benzimidazole group preparations (Suleymenov *et al*., 2011a-b; Juszczak *et al*., 2019).

It is necessary to carry out therapeutic and preventive measures in the Tselinograd district of the Akmola region, considering natural and climatic conditions and the biology of sheep parasitosis pathogens (Zhanabayev *et al*., 2022).

Conclusion

Small cattle in the Tselinograd district were infested with endoparasites such as *Trichostrongylidae* spp. (77.1% and 1,100±98 eggs/g), *Moniezia* spp. (23% and 350±38 eggs/g) and *Eimeria* (55.4% and 1150±102 oocysts/g) and ectoparasites such as *Melophagus ovinus* (65.2% and 1-35 specimens) and *Bovicola ovis* (41.6% and 5-85 specimens). *Dermacentor* spp. was not detected only in Zerenda LLP since animals were not grazed on pastures. In other farms, the average infestation rate was 42.2%, (1-10 specimens). The larval form of *Wohlfarthia magnifica* was found in lacerations in sheep (10.8%, 47 specimens). In the Tselinograd district of the Akmola, *Skrjabinema ovis* and *Trichuris* ovis were found (P of 3.1 and 4.7% and II of 150±22 and 350±23 eggs per g of feces) respectively.

For the successful development of industrial sheep breeding, as well as optimal animal husbandry in individual farms, it is necessary to provide animals with high-quality feed and maintenance, as well as take measures to reduce infectious and invasive diseases.

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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.

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