Helminthofauna of the Digestive Tract of Cattle and Saiga in West Kazakhstan

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Abstract: Purpose of the study. This study aims to determine the helminthofauna of cattle and saiga and identify the main types of helminths in the region of West Kazakhstan. Materials and methods. To study the infestation of cattle and saiga by helminths, the authors used the Fulleborn flotation method. The identification of strangulate to the genus was carried out on the basis of the morphological structure of infective larvae according to P. F. Polyakov and the method of helminthological dissection according to K. I. Skryabin. Thelazia were washed out of the conjunctival sac with a syringe with a stream of a 3% solution of boric acid. Parenchymal organs (liver, lungs) were examined for the detection of cysts of larval custodies.

Results and discussion. Common helminth fauna was observed in cattle and saigas in West Kazakhstan. The results of Fulleborn helminthic and ovoscopic studies of animal feces showed that cattle and saigas were infested with strangylata of the digestive tract of the Trichostrongylidae family from the genera Nematodirus, Haemonchus, Trichostrongylus, as well as the larval cestodoses of Echinococcus granulosus (larvae). Prevalence of cattle infestation with digestive tract strongylata averaged 31.3% and with E. granulosus (larvae) — 35.8%. Prevalence of the infestation of saigas with the nematodes of the digestive tract was 32.0% and with larval cestodoses averaged 16.5%. The contacts of saigas and cattle in pasture areas lead to a common composition of helminths. Saigas are a natural reservoir and a constant source of helminth infestation for domestic ruminants in the West Kazakhstan region. Therefore, when planning treatment and prophylactic measures against helminth infections, this factor should be taken into account.

Conclusions. In West Kazakhstan, nine species of helminths were found in cattle, and fourteen species were found in saigas of the Ural population. All species belong to the classes Cestoda and Nematoda. The contacts of saigas and cattle in pasture areas lead to a common composition of helminths.

Novelty of study. This is the first comparative analysis of the helminth fauna of cattle and saiga. The authors have determined the prevalence and intensity of infestation of the main helminths in the saiga organism in the conditions of West Kazakhstan.

Keywords: cattle, saigas, helminth infections, prevalence of infestation, West Kazakhstan region.

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I. INTRODUCTION

Cattle breeding in West Kazakhstan is one of the leading livestock industries. However, helminthic diseases cause great economic damage. For the development of measures to combat helminth infections in cattle, information on the species composition and epizootiology of helminths in a given region is necessary. K. I. Scryabin was the first to conduct research on the study of cattle's helminthofauna in Kazakhstan [1]. He and his students organized over 30 helminthological expeditions that collected a large amount of material characterizing the species composition of cattle helminths. New data on the fauna of cattle helminths in Kazakhstan were obtained by G. I. Dikov et al. [2]. In Kazakhstan, the helminthofauna of cattle was studied by K. I. Scriabin, R. S. Schulz [3], S. N. Boev et al. [4], E. I. Pryadko [5], B. M. Shonov [6], K. M. Erbolatov [7], V. S. Petrov [8], M. Zh. Suleimenov [9], V. T. Ramazanov [10] and others. In West Kazakhstan, 35 species of helminths from the class of trematodes, cestodes, and nematodes have been registered in cattle. Over the past years, the species composition of cattle helminths could undergo significant changes due to various factors. One of these factors is the wild animals that live in the territory of West Kazakhstan. The most numerous of them are saigas.

Saiga (Lat. Saiga tatarica) is an artiodactyl mammal in the subfamily of true antelopes. It is a relatively small hoofed animal, with the body length from 110 to146 cm and height at withers from 60 to 79 cm. Its weight equals from 23 to 40 kg. It has an elongated body on thin, relatively short legs.

According to "Kazakhstan Today Media Group" (2015), in 2014, the number of saigas reached about 260 thousand individuals belonging to the Saiga tatarica subspecies living in Russia and three regions of Kazakhstan [11-13]. According to K. K. Baitursinov [14], it has been found that regular seasonal migrations of saigas constitute one of the ecological features of their adaptations. These animals have a clear seasonal distribution in natural areas. During the migration period, saiga herds graze mainly on the same pastures as domestic cattle. However, saigas are constantly changing pasture areas.

Saigas and domestic ruminants share from 50 to 100% of common parasites. However, some of these parasites are more specific for saiga. These include A. centripunctata, S. ovis and N. gazellae. Saiga undoubtedly plays an important role in the distribution of parasites and infection of domestic animals. On the contrary, sheep are more intensively infested with the E. granulosus and T. hydatigena taeniidae. Dogs play an active role in the spread of these parasites. The prevalence of saiga infestation with cysts of these cestodes during the study period was rather high. Nematodes are a group of parasites whose infective elements are adapted to living in dry areas. These are nematodes of the Marshallagia and Nematodirus genera. Both groups of animals equally participate in the circulation of these parasites in nature. However, depending on the number of populations and the density of load on the pastures of wild and domestic ungulates, the role of a separate group in the distribution of these nematodes can vary greatly.

A. G. Bannikov [15] notes that 55 species of endoparasites and about 10 ectoparasites were found in saigas in the Caspian region and in Kazakhstan. These include types of parasitic protozoa, cestodes, nematodes. The coefficient of the community of helminths of farm animals and saigas in Kazakhstan is 67-84.7%. A similar situation is noted in the Caspian region.

According to M. Yu. Treys et al. [16], the composition of the helminth fauna of saigas in Askania-Nova includes six types of strongylata, helminths of the gastrointestinal tract, and one type of cestodes, Moniezia expansa. Here interesting observations have been made concerning the formation of the parasitic fauna of the saiga herd.

Contacts of wild and domestic ruminants in grazing areas lead to a common composition of helminths, which is found at the autopsy and during scatological studies. It is known that wild ungulates are subject to various parasitic diseases, often ending in death or loss of valuable commercial qualities, which causes great economic damage and reduces the prestige of national parks and reserves. Despite the fact that adult animals may be less infected than young animals, they are an important source of the spread of infestation and contribute to the occurrence of epizootics. With the widespread occurrence of parasitic diseases, the threat of transmission from wild to domestic animals and humans becomes possible. To combat the parasitic diseases of agricultural and wild animals, various control measures have been proposed, including control of the number of livestock, destruction of animal carcasses, pasture change, rational placement of biotechnical facilities, and other sanitary, veterinary and general economic measures [17].

Published works in the field contain comparisons of helminthofauna of saigas and sheep. However, there are no data comparing the helminthofauna of saigas and cattle.

The purpose of our research is to establish the species composition and the degree of infestation of cattle and saigas by the main types of helminths in the conditions of the West Kazakhstan region.

II. MATERIALS AND METHODS

The infestation of cattle was determined in peasant farms in the steppe, semi-desert and desert zones of the West Kazakhstan region. Saiga infestation was established at the Wildlife Biodiversity Conservation Center, West Kazakhstan Agrarian Technical University named after Zhangir Khan located on the territory of the Taskala region of the West Kazakhstan region where saigas are kept in captivity [18, 19]. We studied the species composition and the degree of infestation of the digestive tract of animals by the main helminth infections. For this purpose, rectal samples of feces were taken from cattle and saigas. Fecal examinations were carried out according to Fulleborn in the laboratory of the Research Institute of Biotechnology and Environmental Management at the West Kazakhstan Agrarian Technical University named after Zhangir Khan. We carried out coprological studies of 298 feces samples from cattle and of samples from 27 saigas. Counting the number of helminth eggs in 1 g of feces was performed using a VIGIS counting chamber [20]. Fecal samples from animals were taken in the morning, rectally. The genus of nematodes of the digestive tract was determined by infective larvae according to P. A. Polyakov [21]. Cultivation of larvae was performed according to N. A. Akulin. For this purpose, animal feces were kept in a thermostat at a temperature of 25-30^{o}C in Petri dishes for 7 days. Feces were moistened and aerated daily. To determine the species composition of helminths in the digestive tract of saigas, we used the method of helminthological dissection according to K. I. Skryabin [22]. To this end, we carried out a helminthological study of the fore-stomachs, abomasum and intestines of 24 dead saigas. The contents of the organs were washed 2-3 times; the precipitate was poured into bags made of silk bolting cloth. The bags were tied and rinsed in water until the complete separation of the turbidity. Then, the contents were viewed in parts using a microscope in a Petri dish, sampling the worms with a brush or a dissecting needle. Helminth identification was performed according to the book by K. I. Skryabin, N. P. Shikhobalova, R. S. Shults et al. “A parasitic nematode identification guide. Vol. 3. Strongylata” [23]. To study the dynamics of the larval cestodosis, we examined serous membranes and parenchymal organs (liver and lungs). When cysts were found, attention was paid to their physiological state and localization. To determine their physiological state, the cysts were punctured and the contents of the bubbles were drawn into a syringe. Then they were examined for the presence of protoscoleces in them and their viability was determined. The viability was determined by heating the water-washed protoscoleces placed in a drop of water on a glass slide with a hole, covered with a cover glass. Viable protoscoleces actively move at a temperature of 38-39^{o}C. The viability was also determined by staining with a 1% methylene blue aqueous solution. All living protoscoleces are not affected by methylene blue solution and the dead ones are colored blue. For the detection of the Thelazia, we injected a 3% boric acid solution into the conjunctival sac from the syringe with a strong jet. The effluent was collected in a cuvette from which the washed worms were removed.

III. RESULTS AND DISCUSSION

Cattle. The results obtained in the study of the species composition of helminths in cattle in the steppe, semi-desert and desert zones of the West Kazakhstan region showed that cattle had parasites of two classes of helminths, four families, eight genera, including nine helminth species, of which four species were biohelminths and five were geohelminths. Three species belonged to the class Cestoda and six species – to the class Nematoda (Table 1).

From the class Cestoda, cattle had parasites of three types of helminths belonging to two families and two genera: Echinococcus granulosus (larvae), Monezia expansa, M. benedeni.

From the class Nematoda, six types of helminths belonging to six genera and two families were identified: Ostertagia ostertagi, Cooperia onchophora, Nematodirus spathiger, Trichostrongylus axei, Haemonchus contortus, Thelazia rhodesi.

The analysis of the study data showed that the greatest infestation of animals was performed by the following helminth species: the class Cestoda (M. expansa and E. granulosus (larvae)) and the class Nematoda (Ostertagia ostertagi, Cooperia oncophora, Thelazia rhodesi).

Four species belong to biohelminths: Moniezia expansa, M. benedeni – localization: the small intestine, intermediate host: soil-dwelling oribatid mites; oribatida (Oribatei), Echinococcus granulosus (larvae) – localization: the parenchymal organs (liver, lungs), intermediate host: agricultural animals and humans; Thelazia rhodesi – localization: the conjunctival sac of the eye, intermediate host: face flies (Musca autumnalis, M. convexifrons, etc).

Five species belong to geohelminths: Trichostrongylus axei, Ostertagia ostertagi, Cooperia oncophora, Haemonchus contortus, Nematodirus spathiger. Localization of worms: abomasum and small intestines. Development occurred without an intermediate host.

Table 1. Species composition of cattle helminths in the West Kazakhstan region.

No.	Helminth species
Class Cestoda (Rudolphi, 1808)	
1.	Moniezia expansa (Rudolphi, 1810)
2.	Moniezia benedeni (Moniez, 1879)
3.	Echinococcus granulosus (Batsch, 1786) (larvae)
Class Nematoda (Rudolphi, 1808)	
4.	Trichostrongylus axei (Cobbold, 1879)
5.	Ostertagia ostertagi (Stiles, 1892)
6.	Cooperia oncophora (Railliet, 1899)
7.	Haemonchus contortus (Rudolphi, 1803)
8.	Nematodirus spathiger (Railiiet, 1896)
9.	Thelazia rhodesi (Desmarest, 1827)

The prevalence of infestation (PI) of animals with Strongylata of the digestive tract averaged 31.3% and the intensity of infestation (II) equaled 98.8 ± 8.9 eggs per 1 g of feces. Cattle were infested with cestodes of the genus Moniezia. The PI of animals with monezia averaged 16.4% and the II equaled 114.5 ± 10.4 eggs per gram of feces. The PI with E. granulosus (larvae) averaged 35.8%. The PI with T. rhodesi averaged 35.8% and the II amounted to 13.3 ± 1.1 specimens per capita.

Saigas. Helminthoovoscopy of saigas showed that animals were infested by representatives of two classes of helminths, six families, 10 genera, including 14 species of helminths, of which three were biohelminths and 11 species were geohelminths.

Of these, three species belonged to the class Cestoda and 11 – to the class Nematoda (Table 2).

From the class Cestoda, in saigas, representatives of three types of helminths belonging to two families and three genera were found: Cysticercus tenuicollis (Taenia hydatigena larvae), Echinococcus granulosus (larvae), Avitellina centripunctata.

From the class Nematoda, 11 types of helminths belonging to seven genera and four families were identified: Skrjabinema ovis, Chabertia ovina, Trichostrongylus colubriformis, T. probolurus, T. skrjabini, Marshallagia marshalli, Haemonchus contortus, Nematodirus spathiger, N. mauritanicus, N. gazellae, Trichocephalus skrjabini (Figure 1).

Analysis of the research data showed that the greatest invasion of animals was noted by the following types of helminths: class Cestoda – Avitellina centripunctata and Cysticercus tenuicollis; class Nematoda – Skrjabinema ovis, Marshallagia marshalli and Nematodirus spathiger.

Three species belong to biohelminths: Avitellina centripunctata – localization: small intestine, intermediate hosts: springtails (Podura) (Collembola); Echinococcus granulosus (larvae) – localization: parenchymal organs (liver, lungs); Cysticercus tenuicollis – localization: serosa of the abdominal and thoracic cavities (omentum, mesogastrium, liver), intermediate host: farm animals and humans.

Eleven species belong to geohelminths: Skrjabinema ovis, Chabertia ovina, Trichostrongylus colubriformis, T. probolurus, T. skrjabini, Marshallagia marshalli, Haemonchus contortus, Nematodirus spathiger, N. mauritanicus, N. gazellae and Trichocephalus skrjabini – localization of helminths: abomasum, small and large intestine. Development occurred without an intermediate host.

The PI of saigas with larvaceous cestodoses averaged 16.5% and with nematodes of the digestive tract – 32.0%.

Table 2. Helminthofauna of the Ural population saigas

No.	Helminth species	PI, %	II, specimen
Class Cestoda (Rudolphi, 1808)			
1.	Cysticercus tenuicollis (Taenia hydatigena larvae) (Pallas,1766)	18.3	9±2
2.	Echinococcus granulosus larvae (Batsch,1786)	14.8	3±1
3.	Avitellina centripunctata (Rivolta, 1874)	31.5	7±2
Class Nematoda (Rudolphi, 1808)			
4.	Skryabinema ovis (Skryabin, 1915)	87.4	427±52

5.	Chabertia ovina (Fabricius, 1788)	32.5	137±65
6.	Trichostrongylus colubriformis (Giles, 1892)	8.7	118±35
7.	T. probolurus (Railliet, 1896) Looss, 1905	28.6	378±128
8.	T. skryabini (Kalantaryan, 1928)	15.4	53±17
9.	Marshallagia marshalli (Ransom, 1907)	78.5	185±16
10.	Haemonchus contortus (Rudolphi, 1803)	15.4	369±254
11.	Nematodirus spathiger (Railiiet, 1896)	46.1	287±68
12.	N. mauritanicus (Maupaset Seurat, 1912)	2.9	4±1
13.	N. gazellae (Sokolova, 1948)	8.6	48±11
14.	Trichocephalus skrjabini (Baskakov,1924)	27.8	27±2

Thus, 14 species of helminths were found in saigas of the Ural population in the West Kazakhstan region. Three species belong to the class of cestodes and 11 — to the class of nematodes. Three species develop with an intermediate host (biohelminths) and 11 species develop without an intermediate host (geohelminths).

Many species of helminths found in saigas are parasitic in cattle and other domestic ruminants. This indicates the possibility of re-infestation with helminths between saigas and cattle when animals come to contact on pasture areas.

Fig. 1. Nematodirus spp., found in the saiga digestive tract: a) the tail end of the female, b) the female with eggs of different stages of development, c) the tail end of the male, d) the area of the female vulva. Enlarged by a scale factor of 60. An original photo taken by the authors.

IV. CONCLUSION

Cattle and saigas in the region of West Kazakhstan are infested with helminths from the Taeniidae and Trichostrongylidae families. They have parasitic larval cestodose of the genus Echinococcus and nematodes from the genera Trichostrongylus, Haemonchus and Nematodirus. Saigas are a natural reservoir and a constant source of helminth infestation in the West Kazakhstan region. Therefore, when planning treatment and preventive measures against helminth infestation of domestic ruminants, this factor should be taken into account.

1. Nine types of helminths have been found in cattle in the West Kazakhstan region.
2. Three species belong to the class Cestoda, and five to the class Nematoda.
3. Four species develop with an intermediate host (biohelminths) and five species — without an intermediate host (geohelminths).
4. Fourteen species of helminths have been found in saigas of the Ural population in the West Kazakhstan region.
5. Three species belong to the class Cestoda and 11 - to the class Nematoda.
6. Three species develop with an intermediate host (biohelminths) and 11 species - without an intermediate host (geohelminths).
7. The helminthofauna from the class Cestoda Cestoda (Echinococcus granulosus larvae) and the class Nematoda (helminths from the genera Nematodirus, Trichostrongylus and Haemonchus) was found to be common in cattle and saigas.
8. The contacts of saigas and cattle in pasture areas lead to a common composition of helminths.

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