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Monitoring of helminth fauna of transhumant cattle in the North Caucasus

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ABSTRACT

The helminth fauna of cattle in the Russian Federation is represented, on average, by 80 parasite species, including 10 trematode species, 13 cestode species and 57 nematode species. In Kabardino-Balkaria and Dagestan, up to 65–100% of cattle population are *Strongylata* and *Anoplocephalata* infected, up to 87% are *Dicrocoelium* infected, up to 40% are *Fasciola* infected, and up to 23% are *Echinococcus* infected. Continuous helminth fauna monitoring tests and studies of the epizootic patterns of helminth infections in transhumant livestock in the North Caucasus are an urgent task. Parasitological examinations were carried out on the farms of the Kabardino-Balkarian Republic that practise vertical transhumance at different altitudes in 2018–2022. The animals of various ages were observed on a year-round basis. The examinations covered transhumant cattle in the subalpine and alpine-subnival subzones of the mountain zone of the Republic, 100 animals per subzone. In the subalpine subzone of the mountain zone of Kabardino-Balkaria, 25 helminth species were detected in the transhumant cattle in the summer and autumn periods, and 7–11 helminth species were detected in the winter and spring periods. The following species prevailed: *Dicrocoelium lanceatum*, *Paramphistomum cervi*, *Trichostrongylus axei*, *Trichostrongylus colubriformis*, *Oesophagostomum radiatum*, *Bunostomum trigonocephalum*, *Nematodirus helvetianus*, *Nematodirus spathiger*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Ostertagiella occidentalis*, *Haemonchus placei*. In the alpine-subnival subzone of the mountain zone of the Republic, 16 helminth species were detected in the transhumant cattle in the summer and autumn periods, and 3–7 helminth species were detected in the winter and spring periods. The following species were found to prevail in this subzone: *Trichostrongylus colubriformis*, *Bunostomum trigonocephalum*, *Dicrocoelium lanceatum*, *Nematodirus helvetianus*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Haemonchus placei*, *Oesophagostomum radiatum*.

Keywords: cattle, transhumance, helminths, fauna, species, extensity, intensity, invasion, North Caucasus, Kabardino-Balkaria

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Мониторинг гельминтофауны крупного рогатого скота при отгонно-пастбищной системе ведения животноводства в условиях Северного Кавказа

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РЕЗЮМЕ

В Российской Федерации гельминтофауна крупного рогатого скота представлена в среднем 80 видами паразитов, среди них 10 видов трематод, 13 – цестод и 57 – нематод. В Кабардино-Балкарии и Дагестане до 65–100% поголовья крупного рогатого скота заражено стронгилятами и аноплоцефалятами, до 87% – дикроцелиями, до 40% – фасциолами, до 23% – эхинококками. Проведение постоянных мониторинговых исследований гельминтофауны и изучение формирования эпизоотического процесса при отгонной системе ведения животноводства на Северном Кавказе является актуальной задачей. Паразитологические исследования выполняли в 2018–2022 гг. в хозяйствах Кабардино-Балкарской Республики, практикующих отгонно-пастбищное

содержание на различных высотах. Наблюдения за животными разного возраста вели круглогодично. Обследованию было подвергнуто по 100 гол. крупного рогатого скота, находящегося на отгонно-пастбищном содержании в субальпийской и альпийско-субнивальной подзонах горной зоны республики. В Кабардино-Балкарии у крупного рогатого скота отгонно-пастбищного содержания в субальпийской подзоне горной зоны в летний и осенний периоды обнаружено 25 видов гельминтов, а в зимний и весенний – 7–11 видов. Доминирующими видами были: *Dicrocoelium lanceatum*, *Paramphistomum cervi*, *Trichostrongylus axei*, *Trichostrongylus colubriformis*, *Oesophagostomum radiatum*, *Bunostomum trigonocephalum*, *Nematodirus helvetianus*, *Nematodirus spathiger*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Ostertagiella occidentalis*, *Haemonchus placei*. В альпийско-субнивальной подзоне горной зоны республики у крупного рогатого скота при отгонно-пастбищном содержании в летний и осенний периоды выявляли 16 видов гельминтов, а зимний и весенний – 3–7 видов. Установлено, что в данной подзоне по распространенности доминируют виды *Trichostrongylus colubriformis*, *Bunostomum trigonocephalum*, *Dicrocoelium lanceatum*, *Nematodirus helvetianus*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Haemonchus placei*, *Oesophagostomum radiatum*.

Ключевые слова: крупный рогатый скот, отгонно-пастбищное содержание, гельминты, фауна, вид, экстенсивность, интенсивность, инвазированность, Северный Кавказ, Кабардино-Балкария

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INTRODUCTION

The North Caucasus is one of the main livestock farming regions of Russia, which is characterized by well-developed sheep farming, dairy and beef cattle farming. Global changes that have taken place in these territories, large numbers of ruminants concentrated within small areas and transhumance create conditions for invasion occurrence [1, 2, 3, 4].

Data on the biology, ecology of agents and the epizootiology of helminthoses in cattle are required to address a variety of theoretical and practical tasks: the detection of infection risk factors in the environment; the assessment of effectiveness of diagnostic, therapeutic, preventive, anti-epizootic measures; the improvement of epizootiological surveillance and strategies aimed at the prevention of parasitic animal diseases [5, 6, 7, 8].

It is known that the development of the epizootic process of many diseases, including helminthoses, is influenced by physical and climatic, as well as economic and ecological factors existing in the regions [9, 10, 11, 12, 13, 14].

Transhumance has a significant impact on animal helminthosis situation [15, 16].

Cattle in the Russian Federation is infected, on average, with 80 helminth species, including 10 trematode species, 13 cestode species and 57 nematode species [17, 18, 19, 20].

In Kabardino-Balkaria and Dagestan, up to 65–100% of cattle population are *Strongylata* and *Anoplocephalata* infected, up to 87% are *Dicrocoelium* infected, up to 40% are *Fasciola* infected, and up to 23% are *Echinococcus* infected [21].

In the Chechen Republic, cattle parasites are represented by 57 species (6 trematode species, 7 cestode species, 44 nematode species) [6, 22, 23, 24].

The specific features of parasite spread depending on the altitudinal zone (subzone), infection occurrence indicators, the epizootic patterns of helminth infections in cattle in the region are under-studied. Therefore, the effectiveness of helminthosis control in animals will depend on making use of knowledge of the agent species composition, epizootiology, seasonal and age-related dynamics, while taking into account the altitudinal zones (subzones) of the region [25].

The aim of the study is the monitoring of helminth fauna and the investigation of the epizootic patterns of helminth infections in transhumant cattle in the North Caucasus.

MATERIALS AND METHODS

Monitoring tests were carried out on the farms of the Republic of Kabardino-Balkaria that practise vertical transhumance at different altitudes in 2018–2022. Laboratory tests were conducted in accordance with GOST R 54627-2011 "Agricultural ruminant animals. Methods of laboratory helminthology diagnostics"[1]. Animal necropsies were performed using K. I. Skryabin's method of complete helminthological necropsy (1928) at the Laboratory for the Study of Invasive Diseases of Farm Animals and Birds of the Caspian Zonal Research Veterinary Institute and at the Chair of Veterinary Medicine of the Kabardino-Balkarian State Agricultural University named after V. M. Kokov.

The animals of various ages were observed on a year-round basis. The examinations covered transhumant cattle in the subalpine and alpine-subnival subzones of the mountain zone, 100 animals per subzone.

[1] https://docs.cntd.ru/document/1200094391

The differentiation of invasion in the animals, including species confirmation, was carried out using the Identification guide to cattle helminths [26].

The data obtained were statistically processed with the Biometrics software (Centre for Biometric Technologies, Russia).

RESULTS AND DISCUSSION

The tests performed revealed that the helminth fauna of transhumant cattle in the subalpine subzone of the mountain zone of the Republic of Kabardino-Balkaria is represented by 25 species in the summer and autumn periods and by 7–11 species in the winter and spring periods (Table 1).

The trematode and cestode species composition in the cattle in this altitudinal subzone includes: *Dicrocoelium lanceatum*, *Fasciola hepatica*, *Paramphistomum cervi*, *Echinococcus granulosus*, *Taenia hydatigena* (larvae), *Moniezia expansa*, *Moniezia benedeni*. Depending on the parasite species, invasion extensity in the animals ranged from 13.0 to 57.0%, and invasion intensity ranged from (2.4 ± 0.3) to (142.6 ± 11.4) parasites/animal.

The tests revealed the presence of the following intestinal and lung nematodes (without intermediate hosts) at different life cycle stages in the cattle: *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Ostertagiella occidentalis*, *Trichostrongylus axei*, *Trichostrongylus colubriformis*, *Trichostrongylus vitrinus*, *Oesophagostomum radiatum*, *Oesophagostomum venulosum*, *Protosrongylus hobmaeri*, *Bunostomum trigonocephalum*, *Bunostomum phlebotomum*, *Haemonchus placei*, *Cooperia punctata*, *Nematodirus filicollis*, *Nematodirus helvetianus*, *Nematodirus oiratianus*, *Nematodirus spathiger*, *Dictyocaulus viviparous*. Depending on the parasite species, significant differences in invasion extensity, which ranged from 12.0 to 88.0%, and invasion intensity, which ranged from (15.8 ± 2.3) to (254.0 ± 24.3) parasites/animal, were detected.

The helminth fauna of transhumant cattle in the alpine-subnival subzone of the mountain zone is represented

Table 1
Helminth fauna of transhumant cattle in the subalpine subzone of the mountain zone (based on the findings from helminthological dissections of organs and tissues)

No.	Species	Cattle ($n = 100$)		
		Number of infected animals	IE, %	Mean II, parasites/animal
1	*D. lanceatum* (Stiles et Hassall, 1896)	57	57.0	142.6 ± 11.4
2	*F. hepatica* (Linnaeus, 1758)	18	18.0	16.8 ± 2.1
3	*P. cervi* (Zeder, 1790)	43	43.0	104.0 ± 9.7
4	*E. granulosus* (Batsch, 1786)	22	22.0	20.2 ± 3.0
5	*T. hydatigena*, larvae (Pallas, 1766)	13	13.0	9.4 ± 1.0
6	*M. expansa* (Rudolphi, 1810)	20	20.0	3.3 ± 0.5
7	*M. benedeni* (Moniez, 1879)	19	19.0	2.4 ± 0.3
8	*T. axei* (Cobbold, 1879)	88	88.0	243.6 ± 22.5
9	*T. colubriformis* (Giles, 1892)	71	71.0	187.8 ± 19.3
10	*T. vitrinus* (Looss, 1905)	32	32.0	104.7 ± 11.8
11	*Oes. radiatum* (Rudolphi, 1803)	48	48.0	109.2 ± 12.6
12	*Oes. venulosum* (Rudolphi, 1809)	35	35.0	73.4 ± 8.3
13	*B. trigonocephalum* (Rudolphi, 1808)	62	62.0	81.2 ± 7.5
14	*B. phlebotomum* (Railliet, 1900)	36	36.0	60.4 ± 6.7
15	*N. helvetianus* (May, 1920)	69	69.0	159.3 ± 17.5
16	*N. spathiger* (Railliet, 1896)	55	55.0	133.4 ± 14.2
17	*N. oiratianus* (Rajevskaja, 1929)	38	38.0	97.3 ± 10.5
18	*N. filicollis* (Rudolphi, 1802)	25	25.0	66.5 ± 8.8
19	*O. ostertagi* (Stiles, 1892)	80	80.0	254.0 ± 24.3
20	*T. circumcincta* (Stadelman, 1894)	69	69.0	198.6 ± 20.9
21	*O. occidentalis* (Ransom, 1907)	53	53.0	111.0 ± 13.6
22	*P. hobmaeri* (Schulz, Orlow & Kutass, 1933)	12	12.0	21.7 ± 3.1
23	*H. placei* (Place, 1893)	59	59.0	92.0 ± 8.3
24	*C. punctata* (Linstow, 1907)	23	23.0	41.4 ± 3.9
25	*D. viviparus* (Bloch, 1782)	18	18.0	15.8 ± 2.3

IE – invasion extensity, II – invasion intensity.

Table 2
Helminth fauna of transhumant cattle in the alpine-subnival subzone of the mountain zone (based on the findings from helminthological dissections of organs and tissues)

No.	Species	Cattle ($n = 100$)		
		Number of infected animals	IE, %	II range, parasites/animal
1	*D. lanceatum* (Stiles et Hassall, 1896)	49	49.0	17–113
2	*E. granulosus* (Batsch, 1786, Rudolphi, 1801)	14	14.0	3–17
3	*T. hydatigena*, larvae (Pallas, 1766)	6	6.0	2–10
4	*M. benedeni* (Moniez, 1879)	11	11.0	2–6
5	*T. colubriformis* (Giles, 1892)	57	57.0	30–144
6	*Oes. radiatum* (Rudolphi, 1803)	36	36.0	21–115
7	*Oes. venulosum* (Rudolphi, 1809)	27	27.0	24–90
8	*B. trigonocephalum* (Rudolphi, 1808)	53	53.0	21–119
9	*B. phlebotomum* (Railliet, 1900)	32	32.0	30–80
10	*N. helvetianus* (May, 1920)	48	48.0	35–141
11	*N. spathiger* (Railliet, 1896)	34	34.0	14–66
12	*O. ostertagi* (Stiles, 1892)	46	46.0	33–150
13	*T. circumcincta* (Stadelman, 1894)	45	45.0	20–190
14	*H. placei* (Place, 1893)	40	40.0	19–121
15	*D. viviparus* (Bloch, 1782)	11	11.0	4–16
16	*P. hobmaeri* (Schulz, Orlow & Kutass, 1933)	12	12.0	3–11

IE – invasion extensity, II – invasion intensity.

by 16 species (Table 2) in the summer and autumn periods and by 3–7 species in the winter and spring periods.

In the alpine-subnival subzone of the mountain zone, invasion extensity and invasion intensity in the cattle ranged from 6.0 to 57.0% and from 2 to 190 parasites/animal, respectively. The following species were found to prevail in this subzone: *Trichostrongylus colubriformis*, *Bunostomum trigonocephalum*, *Dicrocoelium lanceatum*, *Nematodirus helvetianus*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Haemonchus placei*, *Oesophagostomum radiatum*.

CONCLUSION

Twenty-five helminth species were detected in the cattle in the subalpine subzone of the mountain zone of Kabardino-Balkaria. The helminth species composition was characterized by seasonal variations. Depending on the species, trematode and cestode invasion extensity in the animals ranged from 13.0 to 57.0%, and invasion intensity ranged from (2.4 ± 0.3) to (142.6 ± 11.4) parasites/animal. Significant differences in the extensity of invasion with intestinal and lung nematodes (18 species) with direct life cycle (without intermediate hosts), which ranged from 12.0 to 88.0%, and the intensity of invasion, which ranged from (15.8 ± 2.3) to (254.0 ± 24.3) parasites/animal, were detected in the transhumant cattle in this altitudinal subzone.

The helminth fauna of transhumant cattle in the alpine-subnival subzone of the mountain zone is represented by 16 species with a similarity coefficient of 1. Invasion extensity and invasion intensity in the cattle ranged from 6.0 to 57.0% and from 2 to 190 parasites/animal, respectively. The following species prevailed: *Trichostrongylus colubriformis*, *Bunostomum trigonocephalum*, *Dicrocoelium lanceatum*, *Nematodirus helvetianus*, *Ostertagia ostertagi*, *Teladorsagia circumcincta*, *Haemonchus placei*, *Oesophagostomum radiatum*.

Thus, the current cattle helminthosis situation in the region requires regular monitoring, as well as the improvement of measures aimed at parasitic disease control.

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