Research Article

Macro - and Microorganisms of Animals (Helminths and Bacteria) as Indicators of the Degree of Sanitary Pollution of Soil and Water of Mountain Pastures of the North Caucasus

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Abstract | Intestinal nematodes of animals of the genus of as factors of contamination of mountain pastures of the North Caucasus by invasive elements are considered by us for the first time. As seen of in the mountain zone (Elbrus district, Zolsky pastures, and Chereksky district) 60.00 - 90.00% of soil samples are contaminated with eggs of the nematodes genus *Bunostomum* (Raillet, 1902) (average 13,80±1,30 ekz. per 5 g of soil). The dynamics pasture of soil contamination in the mountain zone with eggs of nematodes of the genus *Bunostomum* (Raillet, 1902) was characterized of by an increase in pollution soil samples from 62,00 to 95,00% (on average by 77,60%), which indicates the likely formation of persistent foci of invasion that are dangerous to animal health. In recent years, due to technological errors, the number of animals per 1 ha of pastures has increased by 3-5 times, which has led to an increase in soil pollution by eggs of the genus *Bunostomum* (Raillet, 1902). Up to 100% of soil samples in animal drinking places, in the soils of grazing lands, gardens, residential sectors, and reverie of coastal areas of were contaminated with invasive material of from nematodes of the species *Bunostomum* trigonocephalum and *Bunostomum* phlebotomum, which indicates of a high level of contamination of biotopes of pasture with eggs. The current sanitary condition of the mountainous territories of Kabardino-Balkaria under the conditions of soil contamination with eggs of the nematodes genus *Bunostomum* necessitates urgent measures to organize deworming of the sheep stock 4 times a year (quarterly) with benzimidazole derivatives and avermectins.

Keywords | Region of the North Caucasus; Mountain zone, Pastures, Soil; Nematode, Contamination; Genus *Bunostomum* (Raillet, 1902).

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INTRODUCTION

Spherical of forms of microorganisms, or cocci (staphylococci, streptococci, pneumococcal), as well as rod-shaped forms and actinomycetes (branching, filamentous bacteria), corynebacteria (club-shaped bacteria), mycobacterium and bifidobacteria , of eggs and larvae nematoda of in soilare considered of as dangerous pathogens factors (with the exception of bifidobacteria) for animals and humans (Bittirov et al., 2012, 2013; Vasilevich et al., 2010). In the soil and water of the animal habitat gram-negative bacteria of genus: Meningococcus, Gonococcus, Veilonella, Sticks, Vibrions, Campylobacterium, Helicobacterium, Spirillasum, Spirochetes, Rickettsia, Chlamydium and gram-positive bacteria, Pneumococcus, Streptococcus, Staphylococcus, Bacillus, Clostridium, Corynebacterium, Mycobacterium, Actinomycetes are found in various quantitative and species combinations depending on the region (Atabieva et al., 2012; Shikhalieva et al., 2012; Bittirov, 1999; Bichieva et al., 2011). Eggs and larvae of intestinal nematodes of ruminant animals and bacteria of genus: Meningococcus, Gonococcus, Veilonella, Sticks, Vibrions, Campylobacterium, Helicobacterium, Spirillasum, Spirochetes, Rickettsia, Chlamydium, Pneumococcus, Streptococcus, Staphylococcus, Bacillus, Clostridium, Corynebacterium, Mycobacterium, Actinomycetes as an ecosystem sanitary-hygienic and epidemiological-epizootological threat for the regions of the Russian Federation were considered in many scientific works, of but without taking into account of their landscape and quantitative values contamination of pasture (Vasilevich et al., 2010; Shikhalieva et al., 2012). In many regions of the country, the sanitary and hygienic condition of the soils of the flat territories with respect to their contamination by eggs and helminth enter pathogenic bacteria worsens annually, which the authors attribute an increase in the incidence ruminants of the diseases of gastrointestinal of infectious and parasitic origin (Ardavova et al., 2010). Over the past 10 years, the incidence of young cattle with gastrointestinal nematodoses complicated by enter pathogenic of microflora, especially of the genera Gonococcus, Vibrions, Campylobacterium, Rickettsia, Chlamydium, Pneumococcus, Streptococcus, Staphylococcus, Bacillus, Clostridium, Corynebacterium, Mycobacterium, Actinomycetes, increased by 4-9 times (Zalikhanov et al., 2018; Bichieva et al., 2012). Acute invasions of gastrointestinal nematodoses complicated by enter pathogenic microflora of 19 genera in young of sheep and cattle became enzootic for the mountainous regions of Kabardino-Balkaria. The epizootic situation of by gastrointestinal nematodoses complicated by enter pathogenic microflora of 19 genera is dynamically complicated due to the formation of regional foci in of the mountains zone . Currently, in the Caucasus, about 80% of the territories of animal habitats are contaminated with pathogens of bacterial and parasitic nature. In the regions of the North Caucasus, infection of animals with intestinal nematodes and enter pathogenic microflora is 48-100%. In the southern regions of Russia, ruminants revealed 68 species of intestinal nematodes of more than 400 species of conditionally pathogenic and pathogenic enteric microflora (Bittirov, 2013; Bichieva et al., 2011; Vasilevich et al., 2010; Ardavova et al., 2010; Kolodiy et al., 2012). In this regard, the aim of the work is to study microorganisms of the groups Bacteriae and nematodes of animals as indicators of the degree of sanitary pollution of soil and water of mountain pastures of the North Caucasus.

MATERIALS AND METHODS

The work was carried out on the basis of the parasitology laboratory of the Pre-Caspian Zonal Scientific Research Veterinary Institute in 2015-2019. For this, by 2,000 of soil and 2,000 water samples were taken to identify eggs and larvae of intestinal nematodes before the genus and bacteria of genus: Meningococcus, Gonococcus, Veilonella, Sticks, Vibrions, Campylobacterium, Helicobacterium, Spirillasum, Spirochetes, Rickettsia, Chlamydium, Pneumococcus, Streptococcus, Staphylococcus, Bacillus, Clostridium, Corynebacterium, Mycobacterium, Actinomycetes from different places of the mountain zone (Prielbrussky of mountain pastures, Zolsky mountain of pastures, mountain pastures of the Cherek rayon). The experiments were carried out using modern certified methods of bacteriological and of parasitological studies using the MUK "Methods of sanitary-parasitological and sanitary-bacteriological studies of soil and water". The data were subjected to statistical processing of under the program "Biometry".

RESULTS AND DISCUSSION

The sanitary and hygienic state of the soils of the mountain zone (Prielbrussky of mountain pastures, Zolsky mountain of pastures, mountain pastures of the Cherek rayon) is poorly studied with regard to their contamination with eggs of the genus *Bunostomum* (Raillet, 1902). Studies of soil samples in the context of areas in relation to contamination with eggs of the nematodes genus *Bunostomum* (Raillet, 1902) are presented in Table 1. As seen of in the mountain zone (Prielbrussky of mountain pastures, Zolsky mountain of pastures, mountain pastures of the Cherek rayon) 60.00 - 90.00% of soil samples are contaminated with eggs of the genus *Bunostomum* (Raillet, 1902) (average 13,80±1,30 ekz. per 5 g of soil) (Table 1). Relatively more eggs and larvae of the nematodes genus *Bunostomum* (Raillet, 1902) were found in the soils of the Chereksky district (90.00% of soil samples), which is associated with a high density of ruminants infected with bunostomosis and the formation of a large number of bio

Table 1: Characterization of the sanitary and hygienic condition of the soils of the mountainous territories of Kabardino-Balkaria in connection with their contamination with eggs of intestinal nematodes and enter pathogenic of bacteria 19 genera

Study area	Investigated soil samples	Amount contaminated soil samples	% contaminated samples soil	The number of eggs of intestinal nematodes in 5 g of soil, the specimen and the degree of bacterial 19 genus contamination of the soil
Prielbrussky of mountain pastures	600	420	70,00	12,9±1,1/+++
Zolsky mountain of pastures	600	492	82,00	15,3±1,4/+++
Mountain pastures of the Cherek rayon	800	760	95,00	19,5±1,7/++++
Total:	2000	1672	-	-
Average:	-	-	83,60	15,90±1,40/+++

Note:
+ - a weak level of bacterial soil contamination 1-5 copies. bacteria 20 genus in the field of view of the microscope;
++- the average level of contamination of soils 6-11 copies. bacteria 20 genus in the field of view of the microscope;
+++ - a high level of soil contamination 12-20 copies. bacteria 20 genus in the field of view of the microscope;
++++ - ultra-high level of soil pollution 21-30 or more bacteria of 20 genus in the field of view of the microscope.

Table 2: Dynamics of soil contamination in the mountain zone by eggs of nematodes of the genus *Bunostomum* (Raillet, 1902) (according to coproovoscopy)

Year	Investigated soil samples, ekzemplyar	Discovered soil samples with eggs of the genus *Bunostomum* (Raillet, 1902), ekzemplyar	% contaminated samples soil	Amount eggs of the genus *Bunostomum* (Raillet, 1902) in 5 g samples soil, ekzemplyar
2015	100	59	59,00	10,4±1,0
2016	100	62	62,00	11,6±1,1
2017	100	71	71,00	13,4±1,2
2018	100	80	80,00	14,7±1,4
2019	100	87	87,00	16,5±1,6
Total:	500	359	-	-
Average:	-	-	71,80	13,32±1,26

Table 3: Dynamics of soil contamination on pastures of the mountain zone by eggs of nematodes of the genus *Bunostomum* (Raillet, 1902) (according to coproovoscopy data)

Year	Investigated soil samples, ekzemplyar	Discovered soil samples with eggs of the genus *Bunostomum* (Raillet, 1902), ekzemplyar	% contaminated samples soil
2015	100	62	62,00
2016	100	67	67,00
2017	100	76	76,00
2018	100	88	88,00
2019	100	95	95,00
Total:	500	388	-
Average:	-	-	77,60

topes limneid. In addition, about 75,00% of the animals in the villages of Elbrus district, Zolsky pastures, Chereksky district districts are not dewormed and worsen the epizootic situation in bunostomosis caused by the nematodes genus *Bunostomum* (Raillet, 1902) (Table 1, 2, 3).When studying the dynamics of soil pollution by invasive elements nematode of the *Bunostomum* genus (Raillet, 1902) in the mountain zone (Elbrus district, Zolsky pasture, Chereksky region), an annual gradual increase in the level of soil pollution from 59.00 to 87.00% (average 71,80%).

Table 4: Objects contaminated with eggs of nematodes of the genus *Bunostomum* (Raillet, 1902) in the Kabardino-Balkarian Republic (according ovoscopy soil)

Objects	Number of objects, units	Investigated samples soil, units	Samples soil with eggs of the genus *Bunostomum* (Raillet, 1902), units	% contaminated samples
Animal Watering Places	32	100/3200	3200	100,00
Pasture areas	19	100/1900	1900	100,00
Garden territories	37	100/3700	3700	100,00
Household territories	64	100/6400	6400	100,00
Riverside	16	100/1600	1600	100,00

An increase in the number of eggs in 5 g of soil samples from 10,4±1,0 up to 16.5 ± 1.6 ind. (on average 13,32±1,26 ind. per 5 g of soil) is associated with complete non-compliance with the rules of keeping animals by the local population, sanitary and hygienic standards, the timing and frequency of preventive treatments of sheep against bunostomosis, of approved Department of Veterinary of the Ministry of Agriculture of the Russian (Table 2).

The dynamics pasture of soil contamination in the mountain zone with eggs of nematodes of the genus *Bunostomum* (Raillet, 1902) (Elbrus district, Zolsky pastures, Chereksky district) was characterized of by an increase in pollution soil samples from 62,00 to 95,00% (on average by 77,60%), which indicates the likely formation of persistent foci of invasion that are dangerous to animal health (Table 3).

In recent years, due to technological errors, the number of animals per 1 ha of pastures has increased by 3-5 times, which has led to an increase in soil pollution by eggs of nematodes of the genus *Bunostomum* (Raillet, 1902). In particular, the number of soil samples with the presence of nematode eggs of the species *Bunostomum* trigonocephalum and *Bunostomum* phlebotomum in animal drinking areas increased to 100%, the soil of pasture areas - up to 100%, the soil of vegetable gardens - up to 100%, the soil of residential areas - up to 100%, the coastal territories of rivers - up to 100%, which indicates a high level of pollution of pasture biotopes eggs of the genus *Bunostomum* (Raillet, 1902) (Table 4).

The data obtained are consistent with the results of M., Zhekamukhova, J. Atabieva, A. Bittirova et al., 2012 in that the soils of pasture areas of the mountain zone at altitudes from 2000 to 4000 m above sea level of in 100% cases are contaminated o fwith eggs of nematodes genus *Bunostomum* (Raillet, 1902) with the exception of the winter period and the modern sanitary state of the ecosystem requires constant dynamic monitoring.

CONCLUSION

In the soils of mountain pastures of Kabardino-Balkaria at altitudes of 2000-4000 m above sea level, the degree of sanitary contamination of the soil by invasive elements of the nematodes of the genus *Bunostomum* (Raillet, 1902) meets the criteria of high contamination and requires urgent measures to reduce the incidence of young of sheep with bunostomosis by organizing deworming of the entire stock 4 once a year (quarterly) using highly effective drugs based on benzimidazoles and avermectins.

CONFLICT OF INTEREST

The authors did not have any contradictions when performing the research, they worked according to the plan. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. The co-authors of the article have no conflicts of interest.

NOVELTY STATEMENT

The authors declare that the results obtained on the topic of the article were obtained empirically, and the reflected information is new for science in the field of parasitology and bacteriology.

AUTHORS' CONTRIBUTION

All authors took part in the study of macro- and micro-organisms of animals (helminths and bacteria), as indicators of the degree of sanitary contamination of soil and water in mountain pastures of the North Caucasus, took soil and water samples, analyzed the material, and participated in writing the manuscript. Collectively reviewed the manuscript. All authors read and approved the final version of the manuscript.

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