

UDC 595.132.  
AGRIS L20

<https://doi.org/10.33619/2414-2948/104/09>

## BIOECOLOGICAL CHARACTERIZATION OF NEMATODE DISTRIBUTION AMONG LIVESTOCK IN THE NORTH-EASTERN TERRITORIES OF THE LESSER CAUCASUS OF AZERBAIJAN REPUBLIC

©*Hasanova A.*, ORCID: 0000-0002-2196-3215, Ph.D., Azerbaijan State Pedagogical University, Baku, Azerbaijan, [amalya.hasanova59@mail.ru](mailto:amalya.hasanova59@mail.ru)

## БИОЭКОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА РАСПРОСТРАНЕНИЯ НЕМАТОД СРЕДИ МЕЛКОГО РОГАТОГО СКОТА НА СЕВЕРО-ВОСТОЧНЫХ ТЕРРИТОРИЯХ МАЛОГО КАВКАЗА АЗЕРБАЙДЖАНСКОЙ РЕСПУБЛИКИ

©*Гасанова А. М.*, ORCID: 0000-0002-2196-3215, Ph.D., Азербайджанский государственный педагогический университет, г. Баку, Азербайджан, [amalya.hasanova59@mail.ru](mailto:amalya.hasanova59@mail.ru)

**Abstract.** Helminthological studies of sheep and goats were conducted in the northeastern territories of the Lesser Caucasus of the Republic of Azerbaijan in 2013-2022. The northeastern areas of the Lesser Caucasus include Ganja and Goygeli, Dashkesan, Geranboy, Naftalan, Samukh, Shamkir, Tovuz, Agstafa, Gazakh and Kadabek districts, as well as the areas around the Kura and Jeyranchel rivers, which are wintering places of livestock farms. This process plays a special role in the formation of helminth fauna of animals, as small horned livestock farms in these areas lead a nomadic and sedentary lifestyle. As a result of helminthological research 52 species of helminths, including 43 species of nematodes were identified. Of these, 7 species are indicated for the study region for the first time. All detected nematode species were registered in sheep, while only 26 species were found in goats, which are common to the sheep helminth fauna. These helminth species can be considered as permanent elements of the helminthofaunistic complex of livestock production in the studied region. It was found that young sheep and goats are relatively heavily infested with helminths. Infestation is higher in late spring — early summer and early fall. For this purpose, 957 sheep and 619 goats were examined for nematode pathogens in different landscape-ecological zones of the region by the method of complete helminthological autopsy according to K. I. Skryabin. Some species of helminths are absent in the studied animals before driving them to summer pastures but are observed in them after their return to wintering. Animals become infected by ingesting larvae or mature helminth eggs on summer pastures.

**Аннотация.** В 2013–2022 годах проведены гельминтологические исследования овец и коз на северо-восточных территориях Малого Кавказа Азербайджанской Республики. К северо-восточным районам Малого Кавказа относятся Гянджинский и Гейгельский, Дашкесанский, Геранбойский, Нафталанский, Самухский, Шамкирский, Товузский, Агстафинский, Газахский и Кедабекский районы, а также территории вокруг рек Кура и Джейранчель являющиеся местами зимовки животноводческих ферм. Этот процесс играет особую роль в формировании гельминтофауны животных, так как мелкокорогатые животноводческие хозяйства в этих районах ведут кочевой и оседлый образ жизни. В результате проведенных гельминтологических исследованиях выявлено 52 вида гельминтов, в том числе 43 вида нематод. Из них 7 видов указаны для изучаемого региона впервые. Все обнаруженные виды нематод зарегистрированы у овец, тогда как у коз обнаружено только 26 видов, которые являются общими для гельминтофауны овец. Эти виды гельминтов можно

рассматривать как постоянные элементы гельминтофаунистического комплекса животноводства изучаемого региона. Установлено, что молодняк овец и коз сравнительно сильно заражен гельминтами. Зараженность выше в конце весны – начале лета и начале осени. С этой целью методом полного гельминтологического вскрытия по К. И. Скрябину в различных ландшафтно-экологических зонах региона было обследовано 957 овец и 619 коз на возбудителей нематодозов. Некоторые виды гельминтов отсутствуют у исследованных животных до выгона на летние пастбища, но наблюдаются у них после возвращения на зимовку. Животные заражаются при заглатывании личинок или созревших яиц гельминтов на летних пастбищах.

*Keywords:* goats, sheep, helminths, nematodes, bio-ecological characterization, Lesser Caucasus, Azerbaijan.

*Ключевые слова:* козы, овцы, гельминты, нематоды, биоэкологическая характеристика, Малый Кавказ, Азербайджан.

The helminth fauna of livestock has been studied in the north-eastern territories of the Lesser Caucasus of Republic of Azerbaijan. In 1975, maps were drawn up to study the prevalence of helminthic diseases of farm animals in Azerbaijan. The territory of Azerbaijan Republic has a great variety of physical-geographical conditions, and in connection with this – and the presence of different landscape-ecological zones. This largely determines the nature of livestock breeding, as well as activities to increase the productivity of livestock and control the causative agents of their helminthiasis. The north-eastern territories of the Lesser Caucasus of the Republic of Azerbaijan are very representative in this respect. In this region, practically all large farms engaged in keeping livestock apply the distant form of cattle breeding. Over many years of activity, the livestock farms in the region have developed considerably and have infrastructure meeting modern requirements, including sheep barns, for intensive sheep breeding. In spring, most of the sheep are moved from the lowland areas of the region to the subalpine and alpine meadows of the Lesser Caucasus, and back in the fall.

In sheep farms, along with sheep, there are often domestic goats, which are also objects of distant livestock farming. In rare cases there are purely goat farms. Due to the large number of animals and haphazard use of winter pastures, the region is overloaded with animals. Because of this, sheep often do not receive the necessary amount of feed, which negatively affects their productivity and significantly reduces the economic efficiency of farming. In spring, sheep are driven to summer pastures located in the highland part of the region, where the availability of sufficient natural fodder has a favorable effect on the physical condition of sheep.

Prior to our studies, the helminth fauna of livestock in the north-eastern territories of the Lesser Caucasus of the Republic of Azerbaijan was poorly investigated [1, 4].

In addition, the data of previous studies conducted about 60 years ago are rather outdated. In this regard, the aim of this article is to identify the current state of helminth fauna of the above-mentioned region.

The intensive spread of nematode pathogens is also related to animal housing conditions and climate. These nematodes damage the mucous membrane of the animal's stomach and disrupt nitrogen metabolism.

#### *Material and methods*

The materials for this article were the results of helminthological collections conducted by us in Ganja and Geygel, Dashkesan, Goranboy, Samukh, Shamkir, Tovuz, Akstafa, Kazakh and

Kedabek districts from April 2013 to November 2022 by the method of complete helminthologic autopsy [5].

1576 heads of livestock, including 957 heads of sheep and 619 heads of domestic goats were examined. Incomplete helminthologic autopsies were also conducted on 200 sheep and 120 goats to identify the causative agents of the most dangerous helminthic diseases, including Haemonchosis. In a number of cases, caprological studies were also conducted. Thus, 485 fecal samples were examined by the method of Weid, Fülleborn and sequential washing and viewing of sediment.

For the most complete coverage of all landscape-ecological zones of the region, studies were conducted both in summer pastures Safykurd, Khachagaya, Kerogly Deresi, Kyapaz, Khachbulag, Duz Rasullu of Kedabek district located in mountainous and foothill areas, and in wintering grounds located within the steppe Zayam Jeyranchel. In the livestock farms of Naftalan district animals lead a sedentary lifestyle. Here the studies were conducted in different seasons of the year.

All detected helminths were appropriately recorded and transported to the laboratory for further desktop processing. Trematodes and cestodes were fixed in 70° ethyl alcohol and nematodes in 4% formalin solution. For species determination, trematodes and cestodes were stained with alum carmine and after passing through alcohols of increasing concentration, dehydration in clove oil, were enclosed in Canadian balsam, thus making permanent preparations. Nematodes were examined in temporary preparations, in which they were clarified in a mixture of lactic acid and glycerol in a ratio of 1:1. Olympus microscopes at x20 and x40 magnification were used to identify helminths.

#### Results and discussion

As a result of our research, 43 species of nematodes were found in sheep and goats in the north-eastern territories of the Lesser Caucasus of the Republic of Azerbaijan (Table).

From this number *Ostertagia gruehneri*, *Ostertagia sp.*, *O. leptospicularis*, *Capillaria bovis*, *Protostrongylus raillieti*, *Protostrongylus skrjabini*, *Nematodirella longissimesspiculata* are noted by us for the first time in this region.

Table

SPECIES COMPOSITION OF SHEEP AND GOAT NEMATODES IN THE NORTH-EASTERN TERRITORIES OF THE LESSER CAUCASUS OF AZERBAIJAN REPUBLIC

<i>Helminths</i>	<i>in sheep</i>	<i>in goats</i>	<i>are common</i>
<i>Chabertia ovina</i> Fabricius, 1788	+		
<i>Bunostomum trigonocephalum</i> (Rudolphi, 1808)	+	+	+
<i>B. phlebotomum</i> (Railliet, 1900)	+		
<i>Trichostrongylus andreevi</i> Grigorian, 1952	+	+	+
<i>T. axei</i> Cobbold 1879	+	+	+
<i>T. capricola</i> Ransom, 1907	+	+	+
<i>T. colubriformis</i> Giles, 1892	+	+	+
<i>T. skrjabini</i> Kalantarian, 1928	+	+	+
<i>Trichostrongylus vitrinus</i> Looss, 1905	+	+	+
<i>T. gaobovi</i> Seidov, 1965	+		
<i>T. assadovi</i> Kolesnichenko et Zaidova, 1967	+		
<i>Ostertagia ostertagi</i> Stiles, 1892	+	+	+
<i>O. circumcincta</i> Stadelmann 1899	+	+	+
<i>O. occidentalis</i> Ransom, 1907	+		
<i>O. trifurcata</i> Ransom, 1907	+	+	+
<i>O. trifida</i> Gülle Marotel et Panisset, 1911	+	+	+

<i>Helminths</i>	<i>in sheep</i>	<i>in goats</i>	<i>are common</i>
<i>O. gruehneri</i> Skrjabin, 1929	+		
<i>O. davtiani</i> Grigorian, 1951	+	+	+
<i>O. leptospicularis</i> Asadov, 1953	+		
<i>Ostertagia sp.</i>	+		
<i>Teledorsagia davtiani</i> Andreeva et Satubaldin, 1954	+	+	+
<i>Marshallagia marshalli</i> Ransom, 1907	+	+	+
<i>M. dentispicularis</i> Assadov, 1954	+	+	+
<i>Haemonchus contortus</i> Rudolphi, 1805	+	+	+
<i>Cooperia oncophora</i> Railliet, 1898	+		
<i>C. punctata</i> Linstow, 1906	+		
<i>C. zurnabada</i> Antipin, 1931	+		
<i>C. pectinata</i> Ransom, 1907	+		
<i>Nematodirus abnormalis</i> May, 1920	+	+	+
<i>N. helvetianus</i> May, 1920	+	+	+
<i>N. oiratianus</i> Rajewkaja, 1929	+		
<i>N. spathiger</i> Railliet, 1896	+	+	+
<i>N. junctispicularis</i> Assadov, 1958	+		
<i>Dictyocaulus filaria</i> Rudolphi, 1809	+	+	+
<i>Protostrongylus hobmajeri</i> Schulz, Orloff et Kutass, 1933	+	+	+
<i>P. kochi</i> Schulz, Orloff et Kutass, 1933	+		
<i>P. railletii</i> Schulz, Orloff et Kutass, 1933	+		
<i>P. skrjabini</i> Boev, 1936	+	+	+
<i>Gongylonema pulchrum</i> Molin, 1957	+		
<i>Trichcephalus ovis</i> Abilagaard, 1795	+	+	+
<i>T. skrjabini</i> Baskakov, 1924	+	+	+
<i>Capillaria bovis</i> Schinder, 1906	+	+	+
<i>Nematodirella lonissimespiculata</i> Romanovitsch, 1915	+	+	+
Total 43 species	43	26	26

All nematode species of the parasitic worms we observed were recorded in sheep, while only 26 species were found in goats, all of which are common to the sheep helminth fauna. Table 1 shows that sheep and domestic goats have common helminths *B. trigonocephalum*, *Tr. andreevi*, *Tr. axei*, *Tr. capricola*, *Tr. colubriformis*, *Tr. skrjabini*, *Tr. vitrinus*, *Os. ostertagi*, *Os. circumcincta*, *Os. trifurcata*, *Os. trifida*, *Os. davtiani*, *Teledorsagia davtiani*, *Marshallagia marshalli*, *M. dentispicularis*, *Haemonchus contortus*, *N. abnormalis*, *N. spathiger*, *N. helvetianus*, *Dictyocaulus filaria*, *Protostrongylus hobmajeri*, *P. skrjabini*, *Trichcephalus ovis*, *T. skrjabini*, *Capillaria bovis*, *Nematodirella lonissimespiculata*.

These helminth species can be considered as permanent elements of the helminthofaunistic complex of livestock in the studied region. It should be noted that among the nematodial pathogens of livestock in the north-eastern territories of the Lesser Caucasus of Azerbaijan Republic, there are species that were not observed before our studies. As it is known, during the last 30 years, some livestock farms of Nagorno-Karabakh region have settled in the north-eastern territories of the Lesser Caucasus of the Republic of Azerbaijan. Since, helminths spread in the external environment and helminth exchange occurred in these regions. During the studies it was established that animals are more susceptible to nematodosis pathogens at younger age stages.

Infestations are relatively high in late spring, early summer and early fall. In addition, the observed nematode species such as *Tr. andreevi*, *Tr. axei*, *Tr. capricola*, *Tr. colubriformis* *Os.*

*circumcincta*, *Os. trifurcata*, *Os. trifida*, *Os. davtiani*, *Teledorsagia davtiani*, *Marshallagia marshalli*, *Haemonchus contortus*, *N. abnormalis*, *N. spathiger*, *T. skrjabini* are absent in the studied animals before driving them to summer pastures, but are noted in them after their return to winter pastures. This suggests that infestation occurs in summer pastures. Apparently, this may be an example of the influence of distant confinement of livestock on the infestation of sheep and goats with one or another helminthic agent [2, 3, 6].

Nematodes infestation such as *Tr. axei*, *Tr. vitrinus*, *Os. ostertagi*, *Os. circumcincta*, *Os. trifurcata*, *Os. trifida*, *Haemonchus contortus*, *N. abnormalis*, *N. spathiger*, *N. helveticus*, *Trichcephalus ovis*, *T. skrjabini*, *Capillaria bovis* was noticeably higher in sheep than in goats [6, 7].

The studied territories by their landscape-ecological features are favorable regions for nematode distribution. Therefore, infection of livestock with nematodes occurs in all seasons of the year Figure.

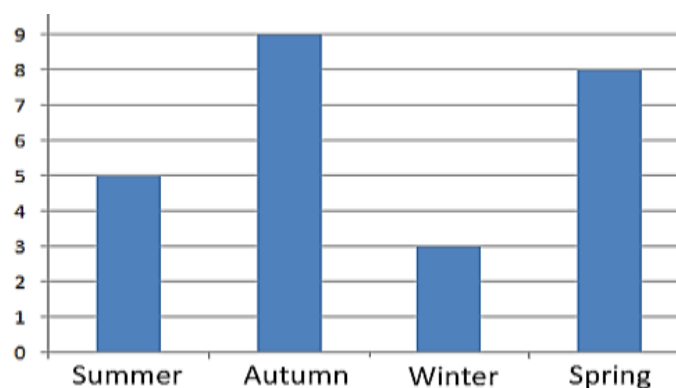


Figure. Infection of livestock with nematodes occurs in all seasons of the year

Of the characteristic elements of helminthofaunistic complex of sheep and goats in lowland areas in the north-eastern territories of the Lesser Caucasus of the Azerbaijan Republic, the most epizootologically important species are of *Haemonchus contortus*, *Trichcephalus ovis*, *Dictyocaulus filaria*.

Analysis of the species composition of nematode pathogens in the studied areas confirmed that the species *Trichostrongylus colubriformis* occurs more frequently in the plains than in mountainous and foothill areas. There is information that this species is more intensively found in the plains of other regions of Azerbaijan [4].

These studies allow improving their devastation methods and developing effective control measures. In most of the study areas, about 15% of the studied sheep were infected with *Chabertia ovina* species. Javadov (1935), Gaibov (1947), Asadov (1959) also found this species in sheep in Azerbaijan [1].

### Conclusions

Livestock farms in the north-eastern territories of the Lesser Caucasus of the Republic of Azerbaijan play an important role in supplying the population of the Republic of Azerbaijan with meat and dairy products, including wool and leather. The bioecological features of each species of these helminths should be studied in order to develop control measures against helminths causing serious damage to livestock farms.

As a result of the study of helminth fauna of livestock in the north-eastern territories of the Lesser Caucasus of Azerbaijan, 43 species of nematode pathogens were found. All found species



were registered in sheep, only 26 species were found in goats, which are common with sheep helminthofauna. These helminth species can be considered as permanent elements of the helminthofaunistic complex of livestock in the studied region. The infestation is higher in late spring - early summer and early fall, 18 helminth species are absent in the studied animals before driving them to summer pastures but are observed in them after their return to wintering grounds. Among the helminths found *Haemonchus contortus*, *Trichcephalus ovis*, *Dictyocaulus filaria* are of the greatest epizootological importance.

In the study of helminth fauna of livestock of the region, the peculiarities of distribution of these helminths were analyzed, special attention was paid to the presence of intermediate and reservoir hosts. It was also established that helminth fauna of livestock depends on the conditions of ferrying and keeping of animals. The reasons for the intensity of helminth infestation of livestock were also investigated.

Localization of helminths is different in goats and in sheep. Different species of helminths occur in different localization sites. It should be noted that the intensity of infection of goats with helminths leads to the infection of goats with various skin diseases. In our studies conducted in different districts of the region, scabies, nodules on the skin and wool loss were observed in goats.

In Tovuz and Gazakh districts, the local population noted cases of premature calving of helminth-infected goats in private and farms.

In goats, many species of protostrongylids and metastrongylids cause severe lesions, localizing in the lungs. They are observed at different levels of pathology, causing severe bronchopneumonia. These helminths cause more severe complications in younger age groups.

Conducting an ecological and geographical analysis of the helminth fauna of livestock in the region allowed us to identify helminths dangerous for humans and other domestic animals in these animals.

Epizootological and epidemiological assessment of helminth fauna of livestock of the region provides preparation of scientific basis for preventive and sanitary veterinary measures against dangerous helminth infections.

These studies should be taxonomic in nature, and the species identified should be defined at the systematic level. When studying the distribution of the constituent elements of helminthocenoses in ecological and geographical zones, the dominant species in the study area and changes in the population dynamics of a particular species under study are taken into account [6]. In analyzing helminthocenosis, one of the relevant problems is to determine whether nematode pathogens are potential or permanent components. There is information in the literature that species of *O. ostertagi*, *C. oncophora* are permanent species in the ruminant helminth fauna complex [3].

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*Работа поступила  
в редакцию 19.06.2024 г.*

*Принята к публикации  
25.06.2024 г.*

*Ссылка для цитирования:*

Hasanova A. Bioecological Characterization of Nematode Distribution Among Livestock in the North-Eastern Territories of the Lesser Caucasus of Azerbaijan Republic // *Бюллетень науки и практики*. 2024. Т. 10. №7. С. 70-76. <https://doi.org/10.33619/2414-2948/104/09>

*Cite as (APA):*

Hasanova, A. (2024). Bioecological Characterization of Nematode Distribution Among Livestock in the North-Eastern Territories of the Lesser Caucasus of Azerbaijan Republic. *Bulletin of Science and Practice*, 10(7), 70-76. <https://doi.org/10.33619/2414-2948/104/09>