



Short Communication

Diversity of Gastrointestinal Nematodes in Domestic Ruminants of Uzbekistan

Makhamadi Abramатов^{1*}, Abdurakhim Kuchboev², Bakhtiyor Ruziev³ and Khumoyun Sobirov²¹Department of Ecology and Soil Science, Termez State University 190111, 43 Barkamol Avlod Street, Termez, Uzbekistan²Laboratory of Molecular Zoology, Institute of Zoology, Uzbekistan Academy of Sciences, 100053, 232B Bagishamol Street, Tashkent, Uzbekistan³Department of Zoology, Karshi State University 180119, 17 Kuchabag Street, Karshi, Uzbekistan

ABSTRACT

This article describes the diversity of gastrointestinal nematodes in domestic ruminants of Uzbekistan. Nematodes were collected from the gastrointestinal tract of 611 small ruminants and 105 of cattle during the 2018-2020 in the farms of in Uzbekistan. These nematodes represented 28 species, including sheep - 25, goats - 21 and, cattle - 22 of these 27 species belonged to in are geohelminthes, and only 1 species was biohelminthes the main core of nematodes of the gastrointestinal tracts of domestic ruminants is 14 species, 11 - facultative and 3 - potential. The total infection was 76.7% in sheep, 61.7% in goats and 55.3% in cattle. Twenty species were common to all ruminants. *Trichostrongylus vitrinus* and *Marshallagia petrovi* were recorded only for one species of ruminants. The species of genus *Trichostrongylus* and *Nematodirus* predominated the gastrointestinal fauna of ruminants in terms of species composition, *P. skrjabini*, *M. marshalli* and *O. ostertagi* were dominant in terms of the intensity of infection.

Article Information

Received 29 June 2021

Revised 03 August 2021

Accepted 21 August 2021

Available online 16 November 2021

Authors' Contribution

MA, BR and KS collected samples. AK and KS performed the analysis. MA and AK wrote the manuscript.

Key words

Nematode, Ruminants, Trichostrongylidae, Gastrointestinal tracts, Infection

Livestock sector plays an important role in Uzbekistan's economy, contributing to the material welfare growth of citizens and the country as a whole. Particular types of the livestock industry products, such as karakul sheep, well known outside the country. Considerable damage to livestock can be caused by helminthosis, which can spread widely in the climatic conditions of Uzbekistan. Nematodes of various species, parasitizing in the gastrointestinal tracts of ruminants, are widespread in landscapes of Uzbekistan. They have a significant effect on the metabolic processes of animals hosts and cause, in some cases, tangible economic damage (Azimov *et al.*, 2015).

Consequently, these problems are significant in conditions of intensive livestock farming. Study of the mechanisms of occurrence of associative invasions and morph-functional relationships in the "host-parasite" system is an urgent problem for theoretical and applied parasitology. Information on the species composition of helminths of domestic ruminants in Uzbekistan is reflected in the investigations of several authors (Dadaev, 1997; Amirov *et al.*, 2014, 2019; Kuchboev *et al.*, 2015, 2016a,

2016b). According to these data, representatives of class Nematoda are discriminated on the largest number of species. This fact is due to the vastness of the problems on study of domestic animals' nematodes in the country. Issues, related to the taxonomic composition features of ruminants nematodes different landscapes are not cleared up completely and there is a need to specify the seasonal dynamics of ruminant infection by different species of nematodes. The recent taxonomic revision, which affected mainly nematodes belonging to superfamily of Ostertagiinae (Nematoda: Trichostrongylidae) (Stevenson *et al.*, 1996; Dallas *et al.*, 2001; Kuznetsov, 2011; Kuchboev *et al.*, 2020) has not yet been taken into account in the work on the species composition of ruminants nematodes in Uzbekistan.

The purpose of this study was to study diversity of the gastrointestinal nematodes of domestic ruminants and their role in the occurrence of associative infections in animals of Uzbekistan.

Materials and methods

Helminthological studies of domestic ruminants have been carried out during the 2018-2020 on a private sectors and farms in Surkhandarya, Kashkadarya, Navoiy, Bukhara, Namangan, Tashkent and Samarkand regions of Uzbekistan.

* Corresponding author: mabramatov@bk.ru
0030-9923/2021/0001-0001 \$ 9.00/0
Copyright 2021 Zoological Society of Pakistan

Table I. Species composition and number of examined ruminants by regions of Uzbekistan.

Host ruminant	Number of animals examined	Study regions						
		Tashkent	Namangan	Samarkand	Bukhara	Navoiy	Kashkadarya	Surkhandarya
<i>Ovis aries</i>	258	25	24	23	55	26	52	53
<i>Capra hircus</i>	311	16	48	34	14	10	93	96
<i>Bos taurus</i>	105	8	23	13	6	14	21	20
Total	674	49	95	70	75	50	166	169

The gastrointestinal tracts of domestic ruminants have been studied by method of total helminthological dissection of individual organs (abomasum and small intestinals) (Anderson, 2000; Anderson *et al.*, 2009). In total, 611 small ruminants (including 258 domestic sheep and 311 domestic goats) and 105 of cattle have been studied by this method (Table I).

Analysis of the materias (contents of the abomasa and shall intestinals) was performed in the Laboratory of Molecular Zoology, Institute of Zoology, Uzbekistan Academy of Sciences and Termez State University. The material collected from the gastrointestinal tracts of individual ruminants was put in flasks, preserved in 70% ethanol and labelled for storage at the collection of the Laboratory of General Parasitology of Institute of Zoology, Uzbekistan Academy of Sciences.

The identification of nematodes was done according to Van *et al.* (2013) and Gibbons (2010). A microscope ML 2000 with digital camera (Meiji, Japan) was used for this purpose.

Results

When domestic ruminants of Uzbekistan were examined, 28 species of nematodes of gastrointestinal tract were recorded, including 25 from sheep, 21 from goats and, 22 from cattle species (Table II). These nematodes are found mainly in a mixed (associative) form. The total infection in sheep was 77.9% (258/201), goats 61.7% (311/192) and cattle 55.3% (105/58). The species of the genera *Trichostrongylus*, *Marshallagia*, *Ostertagia*, *Teladorsagia*, *Haemonchus*, *Nematodirus* and *Parabronema* were identified as components of the associative infection of ruminants.

Common to all ruminant animals were 20 species. *Trichostrongylus vitrinus* and *Marshallagia petrovi* were recorded only for one species of ruminants. The genus *Trichostrongylus* and *Nematodirus* predominates in the gastrointestinal of ruminants in terms of species composition, and *P. skrjabini*, *M. marshalli* and *O. ostertagi* in terms of the intensity of infection.

Table III shows that the main core of ruminant gastrointestinal nematodes is 14 species, facultative elements include 11 species, and the remaining 3 species are potential elements. Species of the genera *Trichostrongylus*,

Marshallagia, *Ostertagia*, *Haemonchus*, *Teladorsagia*, *Nematodirus* and *Parabronema* make up the main core of ruminant abomasum associative infections, and *Orloffia* are facultative. A much poorer group of potential elements includes 2 species-*M. petrovi* and *O. aegagri*.

Table II. Species composition of nematodes in the gastrointestinal tracts of domestic ruminants in Uzbekistan.

N	Family and species of nematodes	<i>Ovis aries</i>	<i>Capra hircus</i>	<i>Bos taurus</i>
Trichostrongylidae				
1	<i>Trichostrongylus axei</i>	+	+	+
2	<i>T. colubriformis</i>	+	+	+
3	<i>T. capricola</i>	+	+	-
4	<i>T. probolurus</i>	+	+	+
5	<i>T. skrjabini</i>	+	+	+
6	<i>T. vitrinus</i>	-	-	+
7	<i>Haemonchus contortus</i>	+	+	+
8	<i>H. placei</i>	-	-	+
9	<i>Marshallagia marshalli</i>	+	+	+
10	<i>M. mongolica</i>	-	+	+
11	<i>M. dentispicularis</i>	+	+	+
12	<i>M. schikhobalovi</i>	+	-	-
13	<i>M. schumakovitschi</i>	+	-	+
14	<i>M. petrovi</i>	+	-	-
15	<i>Nematodirus andreevi</i>	+	+	-
16	<i>N. assadovi</i>	+	+	+
17	<i>N. filicollis</i>	+	-	+
18	<i>N. abnormalis</i>	+	-	+
19	<i>N. helvetianus</i>	+	+	+
20	<i>N. oiratianus</i>	+	-	+
21	<i>N. spathiger</i>	+	+	+
22	<i>Orloffia bisons</i>	+	+	+
23	<i>Ostertagia ostertagi</i>	+	+	+
24	<i>O. gruhneri</i>	+	+	+
25	<i>O. aegagri</i>	+	+	-
26	<i>Teladorsagia circumcincta</i>	+	+	+
27	<i>T. grigoriani</i>	+	+	+
Habronematidae				
28	<i>Parabronema skrjabini</i>	+	+	+

Table III. Groups of species of the gastrointestinal nematodes of domestic ruminants in Uzbekistan.

N	Family and species of nematodes	Groups of species		
		Main core	Facultative	Potential
Trichostrongylidae				
1	<i>Trichostrongylus axei</i>	+	-	-
2	<i>T. colubriformis</i>	-	-	+
3	<i>T. capricola</i>	-	-	+
4	<i>T. probolurus</i>	-	+	-
5	<i>T. skrjabini</i>	-	+	-
6	<i>T. vitrinus</i>	-	+	-
7	<i>Haemonchus contortus</i>	+	-	-
8	<i>H. placei</i>	-	+	-
9	<i>Marshallagia marshalli</i>	+	-	-
10	<i>M. mongolica</i>	+	-	-
11	<i>M. dentispicularis</i>	+	-	-
12	<i>M. schikhobalovi</i>	-	+	-
13	<i>M. schumakovitschi</i>	+	-	-
14	<i>M. petrovi</i>	-	+	-
15	<i>Nematodirus andreevi</i>	-	-	+
16	<i>N. assadovi</i>	-	+	-
17	<i>N. filicollis</i>	+	-	-
18	<i>N. abnormalis</i>	-	+	-
19	<i>N. helveticus</i>	+	-	-
20	<i>N. oiratianus</i>	-	+	-
21	<i>N. spathiger</i>	+	-	-
22	<i>Orloffia bisonis</i>	+	-	-
23	<i>Ostertagia ostertagi</i>	+	-	-
24	<i>O. gruhneri</i>	+	-	-
25	<i>O. aegagri</i>	-	+	-
26	<i>Teladorsagia circumcincta</i>	+	-	-
27	<i>T. grigoriani</i>	-	+	-
Habronematidae				
28	<i>Parabronema skrjabini</i>	+	-	-
Total		14	11	3

Discussion

Our study shows that 27 are geohelminthes and only 1 species (*Parabronema skrjabini*) is biohelminthes (Table II). Epizootic process of these nematodosis of ruminants in Uzbekistan may be characterized as a two or three-component system. Populations of pathogens (Trichostrongylidae) and susceptible animals (ruminants) are involved in two-component system of development

cycles. Nematodes of the family Habronematidae, as well as a population of intermediate hosts (arthropods) and the definitive host (ruminants) are involved in three-component system.

In nematodes of Ostertagiinae subfamily along with the dominant (major) morphs in most cases following minor morphs were found: *Ostertagia lyrata* (*O. ostertagi* f. minor), *Marshallagia occidentalis* (*M. marshalli* f. minor), *Marshallagia trifida* (*M. schumakovitschi* f. minor), *Teladorsagia trifurcata* (*T. circumcincta* f. minor), *Orloffia kasakhstanica* (*O. bisonis* f. minor) (Stevenson *et al.*, 1996; Dallas *et al.*, 2001; Kuznetsov, 2011; Kuchboev *et al.*, 2020; Drozd, 1995).

At present study, *P. skrjabini* occupies the main place in the gastrointestinal tracts of sheep and becomes the predominant form, accounting for 70% of the worms found in the abomasa. We found this species in such a prevailing majority that the pathogenic effect in nematodes of the gastrointestinal tracts of ruminants should be attributed to this species.

Anthropogenic factors also have a certain influence on the course of the epizootic process. Thus, the increase in the infection of domestic ruminants with parabronema observed in recent years is associated with the weakening of measures to combat zoophilic flies and an increase in the number of mixed herds where sheep and goats come into contact with camels - the main sources of this infection (Kuchboev *et al.*, 2016b).

Our investigation show that the associative infections of ruminant animals in Uzbekistan includes 28 species of helminths of the genera *Trichostrongylus* (6), *Haemonchus* (2), *Marshallagia* (6), *Nematodirus* (7), *Orloffia* (1), *Ostertagia* (3), *Teladorsagia* (2) (Trichostrongylidae) and *Parabronema* (1 species) (Habronematidae) (Table III).

It is known that characteristic helminths form the basis for the formation of a certain associative infections. Therefore, we consider the group of such helminths to be the main core of infections, according to work Durette-Desset (1985) with the determination of the "main core" to "potential". In addition to these, there is a group in the infections uncharacteristic species, which we call facultative. The main core and a group of facultative species constitute the main complex of associative infections (Abramatov *et al.*, 2014).

In addition to the indicated groups of species in associative infections, there are also those that are described or identified in a certain zone relatively recently. There is still no data on their distribution, degree of intensity and extensiveness throughout the indicated zone. Species recently described and not yet confirmed by re-registration both in the zone of the original description and in other zones, we classify as potential elements of infections.

Thus, the main core, facultative and potential species, taken together, constitutes a complex of associative infections.

Modern information about animal helminthes makes it possible to consider not only aspects of the relationship between the parasite and the host during various invasions, but also the issues of the interspecific relationship of parasitic worms, the impact of their association on the host organism (Marchenko *et al.*, 2008).

Based on the analysis of the relationship between ruminant rennet nematodes, we assume the presence of antagonistic relationships between genera *Parabronema*, *Marshallagia* and *Haemonchus*. The degree of antagonism between species is correlated with the intensity of invasion. Synergistic relationships are observed between species of the Trichostrongylidae family. This phenomenon is possibly related to the common origin and phylogenetic relationship of these nematodes.

Under the conditions present in Uzbekistan, as in many other regions, the infection of animals by helminthes occurs mainly in pastures that are the habitats of their intermediate hosts and where the conditions are favorable for the development of the eggs and larvae of parasites. In this regard, it is necessary to initiate pasture-based prevention measures for ruminant helminthiasis, ensuring that measures such as changing pastures, grazing regulations, preventive deworming, and maintaining the optional conditions for feeding are not ignored.

Conclusion

Of the 28 nematodes species of the gastrointestinal tracts of domestic ruminants, 27 are geohelminthes and one is biohelminthes. Among those the most common are *M. marshalli*, *O. ostertagi*, *T. circumcincta* and *P. skrjabini*. The total infection of nematodes in sheep was 77.9%, in goats - 61.1% and in cattle - 55.3%. Epizootic processes nematodes with domestic ruminants of Uzbekistan are characterized by two and three-component system. The main core of nematodes of the gastrointestinal tract of domestic ruminants is 14 species, eleven of which are facultative and 3 species are potential.

Acknowledgments

The authors would like to thank Dr Golovanov Vladimir, Institute of Zoology, Uzbekistan Academy of Sciences for technical help of this manuscript. This research did not receive any specific grant from funding agencies in the public, commercial, or for profit sectors.

Statement of conflict of interest

The authors have declared no conflict of interest.

References

Abramatov, M.B., Amirov O.O., Ruziev, B.Kh. and

- Kuchboev, A.E., 2014. *Biol. Sci. Kazakhstan*, **1**: 28-37.
- Amirov, O.O., Abrammatov, M.B. and Karimov, R.R., 2014. *Uzbek Biol. J.*, (**Special Issues 2014**): 13-17.
- Amirov, O.O., Kuchboev, A.E., Sobirova, Kh.G. and Karimova, R.R., 2019. *Bull. Agrar Sci. Uzbek.*, **1**: 112-116.
- Anderson, R.C., 2000. *Nematode parasites of vertebrates: Their development and transmission*. CABI Publish, Wallingford, Oxon, UK. <https://doi.org/10.1079/9780851994215.0001>
- Anderson, R.C., Chabaud, A.G. and Willmott, S., 2009. *Parasit. Vectors*, **2**: 1-2.
- Azimov, D.A., Dadaev, S.D., Akramova, F.D. and Saparov, K.A., 2015. *Helminths of ruminants in Uzbekistan*. Tashkent, pp. 224.
- Dadaev, S., 1997. *Fauna of helminths of vertebrate suborder Ruminantia Scopoli, 1777 in Uzbekistan*. Abstract of doctoral dissertation, pp. 37.
- Dallas, J.F., Irvine, R.J. and Halvorsen, O., 2001. *Int. J. Parasitol.*, pp. 101-103. <https://doi.org/10.1023/A:1011921414269>
- Drozdz, J., 1995. *Syst. Parasitol.*, **32**: 91-99. <https://doi.org/10.1007/BF00009507>
- Durette-Desset, M.C., 1985. *Adv. Parasitol.*, **24**: 239-306. [https://doi.org/10.1016/S0065-308X\(08\)60564-3](https://doi.org/10.1016/S0065-308X(08)60564-3)
- Gibbons, L.M., 2010. *Parasit. Vectors*, **3**.
- Kuchboev, A., Sobirova, K., Karimova, R., Amirov, O., Samson-Himmelstjerna G. and Krucken J., 2020. *Parasit. Vectors*, **13**: 411. <https://doi.org/10.1186/s13071-020-04265-1>
- Kuchboev, A.E., Amirov, O.O., Karimova, R.R. and Asakawa, M., 2016a. *Jpn. J. Vet. Parasitol.*, **15**: 124-129.
- Kuchboev, A.E., Amirov, O.O., Shakarboev, E.B., Karimova, R.R., Golovanov, V.I., Abrammatov, M.B. and Kuznetsov, D.N., 2016b. *Veterinary*, **4**: 28-31.
- Kuchboev, A.E., Krucken, J. and Ruziev, B.H., 2015. *Parasitol. Res.*, **114**: 1355-1364. <https://doi.org/10.1007/s00436-015-4313-6>
- Kuznetsov, D.N., 2011. *Biol. Bull. Acad. Sci. Ras.*, **38**: 608-614. <https://doi.org/10.1134/S1062359011060070>
- Marchenko, V.A., Efremova, E.A. and Vasilyeva, E.A., 2008. *Russian Parasitol. J.*, **3**: 1-6.
- Stevenson, L.A., Gasser, R.B. and Chilon, N.B., 1996. *Int. J. Parasitol.*, **26**: 1123-1126. [https://doi.org/10.1016/S0020-7519\(96\)80013-0](https://doi.org/10.1016/S0020-7519(96)80013-0)
- Van, Wyk J.A. and Mayhew, E., 2013. *J. Vet. Res.*, **80**: E1-E14. <https://doi.org/10.4102/ojvr.v80i1.539>