

HELMINTHOLOGICAL STATUS OF BALKAN CHAMOIS FROM BULGARIAN RHODOPE MOUNTAINS

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ABSTRACT

A herd of Balkan chamois in different ages and sexes has been studied ante-mortally to clarify their helminth infection status. The origin of animals coming from the territory of Bulgarian Rhodope Mountains and they are caught for reintroduction of the species in Vitosha Nature Park.

Low to medium rate of infections with gastrointestinal and lung nematodes has been established. The species of parasites include representatives of the genera *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Ostertagia*, *Nematodirus*, *Protostrongylus* and *Muellerius*.

Key words: helminthological status, Balkan chamois, Rhodope Mountains, gastro-intestinal and lung's nematodes.

Introduction

The Balkan chamois (*Rupicapra rupicapra balcanica* Bolkay, 1925) inhabits several isolated mountains in the Balkan Peninsula. From all of its prior known habitats the species no longer occurs in some and is near extinction. The wild goat inhabits only the high mountains of Bulgaria, Macedonia, Serbia and Northern Greece. This big mammal lives in the alpine and subalpine parts of the mountain over 1,000 meters above sea level where it is the dominant ruminant animal species (2).

In Bulgaria the Balkan chamois inhabits four of the local high mountains – Rila, Pirin, Western Rhodopes and Stara Planina. The population in Stara Planina is isolated and as a result of this is endangered (2, 3). The Balkan chamois has populations of 2300-2600 animals in Bulgaria and it is one of the seven subspecies of the wild goat (*Rupicapra rupicapra* Linnaeus, 1758).

The project "Restoration of the Balkan Chamois in Vitosha Nature Park" is financed by the European Regional Development Fund, the Operational Programme "Environment" (OPE) and the The National Trust EcoFund (NTEF). Experts from Vitosha Nature Park, Vitosha-Studena State Hunting Resort, Executive Forests Agency, Balkan Wildlife Society are involved and it is under the support of the Frankfurt Zoological Society. This is the final step of a ten-year restoration process of the Balkan chamois in Vitosha mountain. The ultimate goal is to establish a stable population of wild goats in Vitosha National Park (3, 5, 17, 18).

The helminth species (parasitic worms) in the Balkan chamois are almost equal to the species found in the domestic goats and other small ruminants inhabiting the European continent. Presence of several parasitic worms specific to this subspecies can be found (4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 21). According to animal species systematics this helminth species belonging to the three main classes in veterinary importance and are distributed among the following families and genera:

- Class Trematoda
 - ✓ Family Paramphistomatidae - genus *Paramphistomum* and *Calicophoron*.
 - ✓ Family Fasciolidae – genus *Fasciola*.
 - ✓ Family Dicrocoeliidae – genus *Dicrocoelium*.

- Class Cestoda
 - ✓ Family Anoplocephalidae – genus *Moniezia*.
 - ✓ Family Thysanosomidae – genus *Thysaniezia*, *Avitellina* and *Stilesia*.
 - ✓ Family Taeniidae – genus *Taenia* and *Echinococcus*.
- Class Nematoda
 - ✓ Family Strongyloidae.
 - ✓ Family Ancylostomatidae.
 - ✓ Family Chabertiidae.
 - ✓ Family Trichostrongylidae.
 - ✓ Family Molineidae.
 - ✓ Family Dictyocaulidae.
 - ✓ Family Protostrongylidae.
 - ✓ Family Spiruridae.
 - ✓ Family Trichuridae.
 - ✓ Family Capillariidae.

Specific to Balkan chamois are the following species of nematodes (8, 10, 11, 13): *Nematodirus rupicaprae* (Nematoda: Molineidae), *Muellerius tenuispiculatus* and *Protostrongylus rupicaprae* (Nematoda: Protostrongylidae).

Aim and tasks

The aim of present study is to establish the helminth status of the Balkan chamois that inhabit the territory of the Rhodope Mountains in Bulgaria.

To achieve our goal, the scientific team has set the following tasks:

- To receive fresh, individual fecal samples from a different age and sex of Balkan chamois.
- To perform ovoscopic and larvoscopic parasitological laboratory analysis by routine tests.
- To summarize and analyze the results connected with the helminthological status of the Balkan chamois.

Materials and methods

Materials

For the present study we have used Balkan chamois (*Rupicapra rupicapra balcanica*) from the Rhodope Mountains in different ages and sex. The herd was caught for reintroduction of a species in the territory of Vitosha Nature Park. Fresh and individual fecal samples from all animals were collected. This survey was done in the late 2014 and early 2015.

Methods

To obtain the data about the helminthological status of the wild goats we used conventional antemortem helminthological methods (1):

- Helminthoscopy.
- Helminthoovoscopy – Salt, Sheather's flotation and passive sedimentation techniques.
- Helmintholarvoscopy – Baerman's modified test.
- Conventional procedure for nematode larvae cultivation.

The genus affiliation was determined based on the morphological data of the parasite sex products (eggs and larvae in first and third stage (16, 19, 20)).

Results and discussion

The results from our study are presented in one table and two figures:

Results presented in Table 1. show that 39 (15 males and 24 females) Balkan chamois were studied in total, divided into three age groups. In all of the observed age groups of animals, low to medium rate of infection by helminth species belonging only to the *Nematoda* class (roundworms) was established.

Table 1: Helminthological status of Balkan chamois from Bulgarian Rhodope Mountains

Age group	Number of examined chamois from both sexes (total)	Genus affiliation of detected infestation by gastro-intestinal nematodes	Genus affiliation of detected infestation by lung nematodes
1. Chamois up to 6 months old.	3 male and 3 female (6)	✓ genus <i>Strongyloides</i>	* negative for infestation
2. Chamois from 1 to 3 years old.	7 male and 12 female (19)	✓ genus <i>Trichostrongylus</i> ✓ genus <i>Haemonchus</i> ✓ genus <i>Ostertagia</i> ✓ genus <i>Nematodirus</i>	✓ genus <i>Protostrongylus</i> ✓ genus <i>Muellerius</i>
3. Sexually mature chamois.	5 male and 9 female (14)	✓ genus <i>Trichostrongylus</i> ✓ genus <i>Ostertagia</i> ✓ genus <i>Nematodirus</i>	✓ genus <i>Protostrongylus</i> ✓ genus <i>Muellerius</i>
Total	15 male and 24 female (39)	5 genera from 3 families (Strongyloidae, Trichostrongylidae and Molineidae)	2 genera from one family (Protostrongylidae)

In wild goats up to 6 months old only sexual products of *Strongyloides sp.* were detected. This is not surprising because these intestinal nematodes are related to young ruminants and then age-related resistance is observed. In animals of age group 1–3 years an infestation by trichostrongylids (genera *Trichostrongylus*, *Haemonchus*, *Ostertagia* and *Nematodirus*) and protostrongylids (*Protostrongylus* and *Muellerius*) have been established. In the third age group (sexually mature chamois) apart from parasites belonging to genus *Haemonchus*, we detected infestation by the same nematode species. During the study infestation by trematodes or cestodes representatives was not observed. The high altitude habitat of the wild goats does not provide a suitable biotope for the intermediate hosts of the most common trematodes in Bulgaria. Surprisingly absence of infestation of *Anoplocephalids* in young wild goats is probably caused by the sampling time (beginning of the winter season). During this period the wild goats are already free from this infestation due to the short lifespan of this tapeworm.

Results presented in Fig.1. approve that in the second age group the three leading nematode genera in Balkan chamois are two from the gastro-intestinal group (*Trichostrongylus* and *Nematodirus*) and one from the lung's one (*Muellerius*). The parasite infestation extensity is highest with *Trichostrongylus spp.* (about 90%), followed by *Muellerius spp.* (74%) and the lowest for *Nematodirus spp.* (42%). In animals from the third age group the same three genera of nematodes were observed as the most common in wild goats (Fig. 2.). The highest infestation extensity was established for *Muellerius spp.* (100%), followed by *Trichostrongylus spp.* (79%) and again lowest rate for *Nematodirus spp.* (57%). *Muellerius spp.* parasites which are one of the most specific for the goat lung nematodes and in adult goats they do not cause disease, due to acquired immunotolerance, even in cases of severe infestation.

The results obtained by scientific team show that the nematode parasites and especially *trichostrongylids* and *protostrongylids* have proven to be of a leading significance as etiological agent for infestation in the Balkan chamois from the Bulgarian Rhodope Mountains. They are found in animals who had lived through at least one warm season (more than one year old) because the disease is a typical pasture helminthiasis. Established low to medium rate of infection by nematodes is typical for wild animals because they inhabit large territory and constantly moving in search for vital resources. Due to the permanent change of a habitat these wild ruminants cannot accumulate severe infestation of nematodes with direct life cycle as trichostrongylids or which requires a specific intermediate host as protostrongylids. Described above rate of infection with nematodes does not reflect on the health status of a chamois neither has any clinical appearance, severe illness or mortality. However, those infestations are making the chamois a natural reservoir of trichostrongylids and protostrongylids which could possibly reflect on environmental contamination with sexual products from those parasites. The pastures inhabited by wild goats are hazardous for infestation of domestic small and large ruminants because of common species of parasites (19).

The possibility for collection of individual, fresh fecal samples from Balkan chamois, nearly extinct and protected by law wild animal species was a great chance for our working team of parasitologists and vets. We have the opportunity to clarify and complete the helminthological status of the chamois without harming them by any way. The collection of fecal samples from the environment of those alpine animals could be extremely challenge because it is unknown when the feces are released and from an animal at what age the materials are. Another problem is the rapid contamination of fecal samples in exterior with free living worms and the development of eggs into other parasite living stage in warm and wet weather conditions. This leads to very difficult and in some cases incorrect identification of the parasite species based on the morphology of their sexual products. Previous studies on parasitic species of Balkan chamois in Bulgaria included only identification and detailed description of lung's nematodes after necropsy following a prior sanitary shot or natural death of wild goats (10, 11).

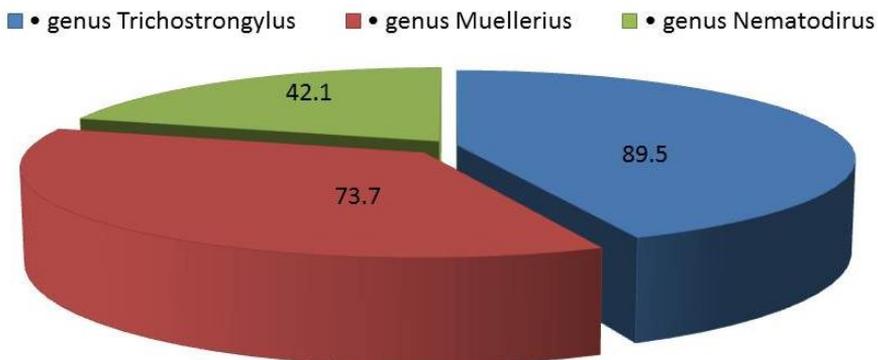


Figure 1: Comparison of the infestation extensity (in %) for the most common nematode genera in Balkan chamois of age group 1 to 3 years.

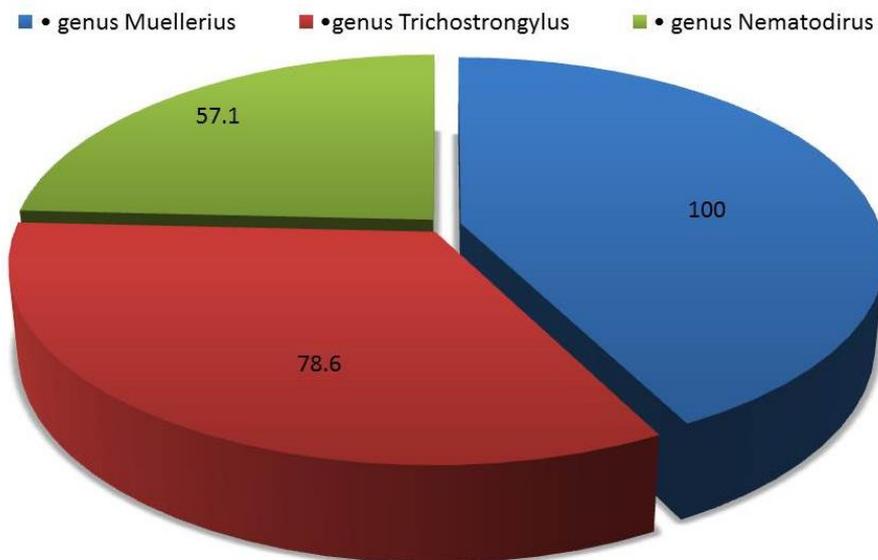


Figure 2: Comparison of the infestation extensity (in %) for the most common nematode genera in sexually mature Balkan chamois.

Conclusion

1. The helminthological status of Balkan chamois from Bulgarian Rhodope Mountains includes infestation with nematode species from the following groups: *strongyloids*, *trichostrongylids* and *protostrongylids*.
2. In young chamois up to 6 months of age are found only sexual products of nematodes from the genus *Strongyloides*.
3. In Balkan chamois of age group between 1 to 3 years the most frequent infestation is by nematodes from *genus Trichostrongylus*, while in sexually mature wild goats are those with protostrongylids belonging to *genus Muellerius*.
4. The rate of infection by nematode parasites in Balkan chamois usually varies from low to medium which is typical for the wildlife animals.

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