

## PULMONARY STRONGYLIDOSIS OF SMALL RUMINANTS IN SERBIA

Ivan PAVLOVIC<sup>1</sup>, Snezana IVANOVIC<sup>1</sup>, Milan P. PETROVIC<sup>2</sup>,  
Violeta CARO-PETROVIC<sup>2</sup>, Dragana RUŽIĆ-MUSLIĆ<sup>2</sup>, Narcisa MEDERLE<sup>3</sup>

<sup>1</sup>Scientific Veterinary Institute of Serbia, J. Janulisa 14, Belgrade, Serbia

<sup>2</sup>Institut for Animal Husbandry, Autoput 16, Belgrade-Zemun, Serbia

<sup>3</sup>Faculty of Veterinary Medicine, 119 Calea Aradului, Timisoara, Romania

Corresponding author email: academician Dr Ivan Pavlovic dripavlovic58@gmail.com

### Abstract

*In pasture breed condition helminth infection are common especially during late spring and autumn months. Research of goats and sheep parasites was made systematically last 10 years in Serbia. Most of the research related to gastrointestinal and something less about lung helminth infection. The research was carried out on several locations in Serbia in the period and included goat and sheep herds in the area of carried out in north, northeast, eastern, southern and south-eastern part of Serbia and at Belgrade area. We examined fecal samples using the Berman method. Slaughtered or dead animals we examined by necropsy and adult parasites separated from the lung section. Determination of adult and larval stage of parasites was based on the morphological characteristics. During our examination most abundant species was Dictyocaulus filaria, followed by Protostrongylus rufescens, Cystocaulus nigrescens and Muellerius capillaris.*

**Key words:** small ruminants, lung worm, Serbia.

### INTRODUCTION

The grazing diet allows the permanent contact of small ruminants with intermediate hosts and the eggs and larval forms of the parasite. From these reason parasitic infections are present worldwide in a large number of herds (Berrag and Urquhart 1996; Alemu *et al.*, 2006; Geurden and Vercruyse, 2007; Pavlovic *et al.*, 2009a, 2012, 2013; Alasaad *et al.*, 2010).

Lungworms of domestic ruminants are nematodes that belongs to the phylum Nematelmenthes commonly named as round worms; classified under the super family Trichostrongyloidea and Metastrongyloidea (Tewodros, 2015). Of which, *Dictyocaulus* and *Protostrongylus* are causes of lungworm infection in ruminants (Taylor *et al.*, 2007; Palic, 2001; Pavlovic *et al.*, 2009b, 2010a). They induce verminous pneumonia which was a significant health problem of sheep and goats. Pulmonary strongilides of small ruminants are most commonly occur in pastures with lush vegetation (Pavlovic *et al.*, 2009b, 2010a). Pasture infectivity is related to rainfall which stimulates the activity of both the larvae and the mollusk. Moisture is essential for the survival and development of the larvae. The

larvae is active at moderate temperature of 10-21°C. Larvae survive best in cool, damp surroundings especially when the environment is stabilized by the presence of long herbage of free water.

In our paper we present the results obtained on the prevalence of pulmonary strongilides in sheep and goats in Serbia, based on research done in the last few years.

### MATERIALS AND METHODS

Investigations performed in period 2012-2018 and included 430 herds of goats and sheep in the area of Belgrade, Stara Planina, north-eastern, central and southern part of Serbia and in Vojvodina.

In total, 4300 fecal samples were examined by the Berman method. At the same time, we have done the autopsy of 387 animals on the slaughter line or after death. After that routine necropsies of the lungs were performed. The helminths within the particular lesion were found and their species were determined under the microscope.

Determination of parasites larvae and adult parasites was based on its morphological characteristics (Dunn, 1978; Euzeby, 1981).

## RESULTS AND DISCUSSIONS

During our studies, infection with pulmonary strongilides was recorded in 327 (76.04%) herds. Based on the autopsy we revealed the presence of *Dictyocaulus filaria* (47.02%), *Protostrongylus rufescens* (74.01%), *Muellerius capillaris* (37.20%) and *Cystocaulus nigrescens* (19.12%). On the basis of autopsy and coprological examination average prevalence of *D. filaria* was 60.52%, *P. rufescens* 74.01%, *M. capillaris* 39.22% and *C. nigrescens* 19.31% (Figure 1).

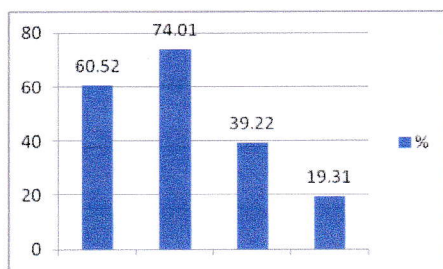


Figure 1. Average prevalence of lungworms infection

*Dictyocaulus filaria* was occurred at all small ruminants heard from all part of country and prevalence was from 12.24 to 60.52%. The highest prevalence is observed in the herds in Vojvodina, north and southeastern Serbia where predominate flat plain pastures. Due to microclimatic conditions, the infection usually occurs in the period April-May when the largest number of animals are grazing. This has been confirmed by research on grass on pastures for the presence of larvae of parasites (Regasa *et al.*, 2010; Pavlovic *et al.*, 2017).

These 3.5-9 cm long parasites live in the lumen of the bronchi and trachea. During autopsy, we found parasites in the bronchi where they caused chronic bronchitis and peribronchitis. The most common pathological changes we have encountered are presence of parasites and abundant purulent mucous membranes obstruct the lumen of the bronchi so that distal bronchial collapse, dark red atelectasis, or pale emphysematous fields (Figure 2).



Figure 2. *Dictyocaulus filaria* in sheep lung

From the subfamily *Protostrongylinae* we registered genera *Protostrongylus*, *Cystocaulus* and *Muellerius* (Pavlovic *et al.*, 2010a; Ivanović and Pavlović, 2015). Parasites are predominant at herd grazed at hill side of mountains, especially at eastern, central and southern part of Serbia. *Protostrongylinae* are biohelminthes and need intermediate hosts for their development - snails and slugs (Diez-Baños *et al.*, 1989; Manga and Morrondo, 1990; Morrondo-Pelayo *et al.*, 1992). During our examination in pastures in various parts of Serbia we concluded that the most common intermediate hosts are *Abeda frumentata*, *Arion ater*, *A. subfuscus*, *Cepae vindobenensis*, *Helix aspersa*, *H. pomatia*, *Chondrula tridens*, *Fruticola fruticum*, *Deroceras reticulatum*, *Eucomphalia strigella* and *Helicella obvia*. Due to microclimatic conditions, the infection usually occurs in the March and April when the largest number of intermediate host are present at pasture (Pavlovic *et al.*, 2010b).

During examination most abundant species was *Protostrongylus rufescens* occurred on 21.93 to 77.21%. These nematodes live in bronchioles and alveoli, are reddish in colour and relatively small - the male is 16-28 mm long and the female is 25-35 mm long (López *et al.*, 2011). The parasitic lesions established in the present study were located within the caudal lung lobes and were disseminated mainly within the dorsal subpleural parenchyma (Figure 3).

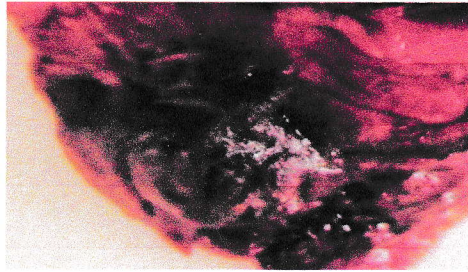


Figure 3. *Protostrongylus rufescens* in goat lung

From the genus *Cystocaulus* we occurs *C. nigrescens*. Adult parasites live in the pulmonary parenchyma (Mengestom, 2008). The parasites are gray-white in colour. Males are 18-24 mm long and female's 40-50 mm. Prevalence are ranges from 12.22 to 39.22%. On diaphragmatic lobes we found cone-shaped granulomas in lung tissue that varied in size, color, and degree of consolidation (Hubado, 2010; Domke et al., 2013). They contain sexually active parasites with a mass of eggs and larvae. The nodules were as large as the head of a dark brown to black if *Cystocaulus* sp. was present (Figure 4).

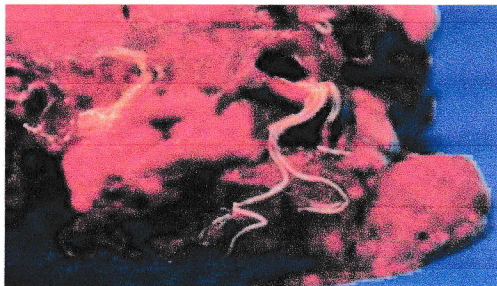


Figure 4. *Cystocaulus nigrescens* in sheep lung

From the genus *Muellerius* occurs *Muellerius capillaris*. Parasites live in the bronchioles and alveoli. The body of the parasite is thin white. The prevalence ranges was from 4.23 to 19.31%. The lung lesions in goats infected with *M. capillaris* were nodular, firm, and gray located in the dorsal surface of the caudal lung lobes (Tenaw and Jemberu, 2018). The lesions in the lungs of sheep were more severe, regardless of the animals' age. In the most cases they were not formed as nodules and were dark grey to black areas affecting a large part of the lung surfaces (Figure 5)

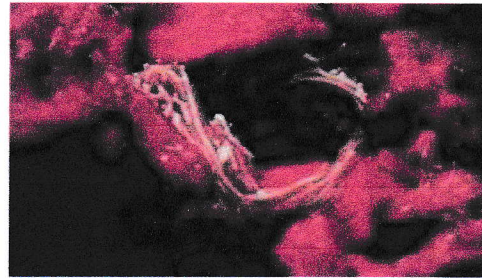


Figure 5. *Muellerius capillaris* in sheep lung

From the presented data, it can be seen that the biodiversity of pulmonary strongylides of small ruminants is similar to that of the whole of Europe (Rose, 1973; Diez-Baños et al., 1989; Manga and Morrondo, 1990; Morrondo-Pelayo et al., 1992; Berrag et al., 1996; Geurden and Vercruysse, 2007; Alasaad et al., 2009; Stanchev et al., 2010; Panayotova-Pencheva and Alexandrov, 2010).

Our examination are the first systematically studies of pulmonary strongilides in Serbia, and are related to determining the prevalence of parasitic infections, species of lungworm of sheep and goats as well as their vectors.

## CONCLUSIONS

Based on the results obtained, we can conclude that a large number of sheep and goats in Serbia are infected with pulmonary strongilides. *Protostrongylus rufescens* and *Dictyocaulus filaria* are the dominant species, while *Muellerius capillaris* and *Cystocaulus nigrescens* are present in a smaller percentage.

## ACKNOWLEDGEMENTS

This study was supported by the Ministry of Education, Science and Technological Development, Republic of Serbia (Contract for research funding No. 451-03-68/2020-14/200030) and its part of project BT 31053.

## REFERENCES

- Alasaad, S., Morrondo, P., Dacal-Rivas, V., Soriguer, R.C., Granados, J.E., Serrano, E., Zhu, X.Q., Rossi, L., & Pérez, J.M. (2009). Bronchopulmonary nematode infection of *Capra pyrenaica* in the Sierra Nevada massif, Spain, *Veterinary Parasitology*, 164(2-4), 340-243.

- Alemu, S., Leykun E.G., Ayelet, G., & Zeleke, A. (2006). Study on small ruminant lungworms in northeastern Ethiopia, *Veterinary Parasitology*, 142(3-4), 222-330
- Berrag, B., & Urquhart, G.M. (1996). Epidemiological aspects of lungworm infections of goats in Morocco. *Veterinary Parasitology*, 61(1-2), 81-85.
- Diez-Baños, P., Morrondo-Pelayo, M.P., Diez-Baños, N., Cordero-Del-Campillo, M., & Núñez-Gutiérrez, M.C. (1989). The experimental receptivity of *Helicella* (*Helicella*) *itala* and *Cepaea nemoralis* (Mollusca, Helicidae) to larvae of *Muellerius* sp. and *Neostongylus linearis* (Nematoda, Protostrongylidae) from chamois (*Rupicapra rupicapra*). *Parasitology Research*, 75(6), 488-494.
- Domke, A. M., Chartier, C., Gjerde, B., Leine, N., Synnøve Vatn, S., & Stuen, S. (2013). Prevalence of gastrointestinal helminths, lungworms and liver fluke in sheep and goats in Norway. *Veterinary Parasitology*, 194, 40-48.
- Dunn, M.A. (1978). *Veterinary helminthology*. London, UK: William Haineman Medical Books ed.
- Euzeby, J. (1981). *Diagnostic experimental de helminthoses animals*, Paris, Franc: ITVC.
- Geurden, T., & Vercruyse, J. (2007). Field efficacy of eprinomectin against a natural *Muellerius capillaris* infection in dairy goats, *Veterinary Parasitology*, 147(1-2), 190-193.
- Hubado, H. (2010) Prevalence of lungworms of small ruminants in Assela and its surroundings, DVM thesis, University of Gondar, Gondar Ethiopia.
- Ivanović, S., Pavlović, I. (2015). Meso koza - bezbedna namirnica. Beograd, Srb: NIVS.
- López, C.M., Fernández, G., Viña, M., Cienfuegos, S., Panadero, R., Vázquez, L., Díaz, P., Pato, J., Lago, N., Dacal, V., Diez-Baños, P., & Morrondo, P. (2011). Protostrongylid infection in meat sheep from Northwestern Spain: prevalence and risk factors. *Veterinary Parasitology*, 178 (1-2), 108-114.
- Manga, M.Y., & Morrondo, M.P. (1990). Joint larval development of *Cystocaulus ocreatus*/ *Muellerius capillaris* and *C. ocreatus*/ *Neostongylus linearis* (Nematoda) in six species of Helicidae (Mollusca) experimentally infected. *Angewandte Parasitologie*, 31(4), 189-197.
- Mengestom, G. (2008) Preliminary study on prevalence of ovine lungworm infection in Atsbithe. DVM Thesis, Jimma University, Jimma, Ethiopia.
- Morrondo-Pelayo, P., Diez-Baños, P., & Cabaret, J. (1992). Influence of desiccation of faeces on survival and infectivity of first-stage larvae of *Muellerius capillaris* and *Neostongylus linearis*. *Journal of Helminthology*, 66(3), 213-219.
- Palić, D. (2001). *Bolesti koza*. Pančevo, Srb: Grafos internacional.
- Panayotova-Pencheva, M.S., & Alexandrov, M.T. (2010). Some pathological features of lungs from domestic and wild ruminants with single and mixed protostrongylid infections. *Veterinary Medicine International*, 2010:741062. Epub
- Pavlović, I., Ivanović, S., Žujović, M., & Tomić, Z. (2010a). Plućna strongilidoza koza. Zbornik naučnih radova Instituta PKB Agroekonomik, 16(3-4), 171-177.
- Pavlović, I., Anđelić-Buzadžić G., & Ivanović S. (2010b). Gastropode prelazni domaćini protostrongylida koza. *Savremena poljoprivreda*, 59(5). Special issue, 502-508.
- Pavlović I. (2017). Sedimentation method of grass testing for the presence of larvae of parasites (Republic of Serbia, The Intellectual Property Office, certificate no 4202/2018A-0130/2018)
- Regassa, A., Toyeb, M., Abebe, R., Megersa, B., Mekibib, B., Mekuria, S., Debela, E., & Abunna, F. (2010). Lungworm infection in small ruminants: prevalence and associated risk factors in Dessie and Kombolcha districts, northeastern Ethiopia. *Veterinary Parasitology*, 169(1-2), 144-148.
- Stanchev, A., Panayotova-Pencheva, M., & Tsvyatkov Alexandrov, M. (2010). Some pathological features of lungs from domestic and wild ruminants with single and mixed protostrongylid infections. *Veterinary Medicine International Article ID* 741062, pages 9.
- Tenaw, A., & Jemberu, W.T. (2018). Lungworms in small ruminants in Burie district, Northwest Ethiopia. *Ethiopian Veterinary Journal*, 22(2), 26-35.
- Tewodros, A.E. (2015). A review on: lungworm infection in small ruminants. *World Journal of Pharmaceutical and Life Sciences*, 1(3), 149-159.
- Taylor, M.A., Coop, R.L., Wall, R.L. (2007). *Veterinary parasitology*. 3 rd ed. Oxford, UK: Blackwell Published Ltd.