Full Length Article

OCCURRENCE OF *Dictyocaulus filaria* INFECTION IN AN ORGANIZED SHEEP FARM OF TAMIL NADU, INDIA

M. Prabhu [1*], C. Sreekumar[2], N. Prema[3], P.C. Sakthivel[4], R. Anilkumar[5] and M. Iyue[6]

Sheep Breeding Research Station
Tamil Nadu Veterinary and Animal Sciences University
Sandynallah, Nilgiris District – 643 237 Tamil Nadu, India

ABSTRACT

The sheep lungworm Dictyocaulus filaria is of world-wide distribution and causes verminous pneumonia which may result in weight loss and death of the infected sheep. The current investigation was carried out in an organized farm in the Nilgiris district of Tamil Nadu, India during the period from 2012 to 2014. Infected sheep showed clinical illness varying from dullness, depression, moderate coughing, dyspnoea and labored breathing with little mortality. On necropsy, both larval and adult stages of lungworm were recovered from trachea, bronchi and bronchioles. The identity of the nematodes was confirmed as D. filaria based on the socks shaped spicules in males and anterior knob in the larva. Of the 55 animals, including 17 lambs examined during the study period, eight animals were confirmed to have died due to verminous pneumonia. Apart from that, in a few lambs, lung abscess was noticed. Though the infection was present throughout the year, the clinical illness was pronounced in dry summer (n=23) and rainy season of south west monsoon (n=19). The disease was managed by minimizing the exposure of lambs to the contaminated pasture and by deworming with two doses of levamisole hydrochloride @ 7.5 mg/ kg body weight at 21 day interval to control the lungworm infection in sheep.

Key words: Sheep, *Dictyocaulus filaria*, Verminous pneumonia, Tamil Nadu, India

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[1] Assistant Professor, Department of Veterinary Microbiology, Veterinary College and Research Institute, Udumalpet, Tamil Nadu - 642 205, Corresponding author Email: drprabhuvirol@gmail.com

[2] Professor and Head, Department of Wildlife Science, Madras Veterinary College, Chennai - 600 007

[3]Assistant Professor and Head,

[4]Assistant Professor, Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal - 637 001

[5]Director of Distance Education, Tamil Nadu Veterinary and Animal Sciences University, Anna Salai, Nandanam, Chennai – 600 035

[6]Professor (Rted)

INTRODUCTION

India has the largest sheep population following China (Hegde, 2019) and the total sheep population is about 74.26 million during 2019 and is about 13.8% in total livestock population of the country. This count has increased by 14.13% over previous five years period. The population of sheep is about 4.5 million in Tamil Nadu state, which ranks fifth in position among Indian states (Department of Animal Husbandry and Dairying, 2019; dadh.nic.in). Sheep plays a major role in the livelihood of small and marginal farming community engaged in sheep husbandry through sale of animals.

About half of the loss in terms of mortality and morbidity in sheep farms are caused by pneumonia and endoparasitism including lungworms (Asaye and Alemneh, 2015; Adem, 2016). Ovine lungworms are one of the major respiratory parasites of sheep that are worldwide in distribution particularly common in temperate countries and in high land of tropical and sub-tropical countries (Tesfaye *et al*., 2015*). Dictyocaulus filaria, Muellerius capillaris* and *Protostrongylus rufescens* are the three important nematodes that cause lungworm infection in sheep (Radostits *et al*., 2007). Although mixed infections of these round worms may occur, in the majority of outbreaks *D. filaria* is found to be the predominating species (Urquhart *et al.,* 1996). It is also more pathogenic (Umur *et al*., 2006) and economically significant in sheep husbandry. The lungworms enter the host by ingestion of infective larvae, have direct life cycle and are located in the respiratory tract of the lungs causing chronic syndrome of coughing, unthriftiness in lambs and kids (Tesfaye *et al*., 2015). They suppress the immunity of respiratory tract of host and hence lead to bronchitis or pneumonia resulting in loss of production in terms of loss of body condition / weight and death (Gelagay *et al*., 2004).

Depending on the predisposing or risk factors, the incidence of this lungworm infection varies from place to place. Though there are reports on lungworm infection in sheep from various parts of the world, the published literature is rather rare in the Nilgiris district of Tamil Nadu. The current investigation deals with the occurrence of lungworm infection in an organized sheep farm of the Nilgiris district of Tamil Nadu, a southern state of India.

MATERIALS AND METHODS

Study area

The investigation was carried out during the period of January 2012 to October 2014 in Sheep Breeding Research Station (SBRS) an organized farm situated at Sandynallah which is located at latitude of 11° 26' 15.25" north and longitude of 76° 38' 27.34" east in the Nilgiris District, Tamil Nadu state, India. It is situated in the Nilgiri Biosphere Reserve in undulating hill range at 2090 – 2235 m above MSL. The annual mean temperature and rainfall ranges from 0-24^{o}C and 840 – 3000 mm, respectively.

Study animals and management

The Nilagiri, Sandyno and Dorset x Nilagiri cross breeds are the three breeds maintained at SBRS with the average flock strength of 1382, 1307 and 1390 in the years 2012, 2013 and 2014, respectively. The animals were vaccinated once with Johne's disease vaccine after 10 days of birth and once or twice a year with formalin inactivated, alum precipitated enterotoxaemia vaccine. They were dewormed twice with Fenbendazole and Praziquantel during the first three months of life and then followed by deworming with morantel citrate in the hogget and adult animals once in three months period. The animals were maintained under semi-intensive system and allowed for ~ 8 hours grazing in an open pasture; fed with concentrate containing 18% of crude protein in the sheds with ad libitum water even in pasture. During winter and early summer (January to May), the animals received additional supplement of silage prepared from fodder maize.

Clinical picture and postmortem screening of animals

During the study period, many animals showed the clinical manifestations suggestive of respiratory illness such as nasal discharge, ill thrift, weight loss, coughing/ dyspnoea, labored breathing with a few mortalities. A total of 293 sheep carcasses were examined during the study period. The major sites screened for the presence of lungworms include their respiratory passages *viz*., trachea, lung, bronchi and bronchioles. Representative samples (n=8) from lung that showed the marked lung lesions along with worms were sent for histopathological examination at Central University Laboratory, Tamil Nadu Veterinary and Animal Sciences University, Chennai.

RESULTS AND DISCUSSION

The serious respiratory ailment in domestic small ruminants caused by the parasites called verminous bronchitis or otherwise referred as hoose or husk is worldwide in distribution and is endemic in temperate regions with high rainfall (Taylor *et al.*, 2007). Dictyocaulosis is known to be potentially increasing, and expensive trouble (Ploeger, 2002) in many areas. The prevalence of this illness varies from place to place depending on the climatic factors and ecological conditions such as rainfall, humidity and temperature of the area. Further, the pasture contamination, number of infective larvae in the grazing field, management system followed and immune status of the animals are additional factors contributing to the severity of this infection (Dar *et al.,* 2012).

In the current investigation, the occurrence of the *D. filaria* infection is recorded from the organized sheep farm for the period of three years from 2012-2014. In the flock, many animals showed the clinical manifestations suggestive of respiratory illness. The characteristic clinical signs exhibited by the affected sheep varied from mild depression, dullness, pyrexia, nasal discharge and moderate coughing to severe dyspnoea and labored breathing with a few mortalities. Some animals showed ill thrift

with reduced weight gain, loss of weight, emaciation with retarded growth. These findings were in concurrence with earlier reports (Elsheikh and Khan, 2011; Chakraborty *et al.,* 2014). In severe cases, heavily infected sheep showed characteristic stance with their heads extended forward and open mouth with drooling of saliva.

The pathogenesis of *D. filaria* also depends on their predilection site and the location within the respiratory tract of the animal. They live mainly in the trachea and bronchi affecting a large volume of lung tissue due to aspirated eggs, larvae and debris and hence are considered to be the most pathogenic lungworm species (Tewodros, 2015). In our study, both larval and adult stages of lungworm were recovered from trachea, bronchi and bronchioles. These lungworms were recovered from 55 animals out of 293 animals necropsied during the study period. The details were shown in tables 1 and 2**.** Among the positive animals, eight sheep were confirmed to have died mainly due to verminous pneumonia without any other characteristic lesions or confirmed etiology. Further, the histopathology results also confirmed the presence of sections of lungworms.

Further, in seven lambs, tiny nodular lesions or abscesses were noticed in the caudal lobes of lungs with catarrahal bronchitis which is similar to the previous observation of Chilton *et al*. (2006). The lungs revealed the areas of congestion and consolidation. When dissected, numerous slender, thread-like, creamy white worms were found numbering from very few to bunches along with copious frothy fluid (Fig. 1 and 2). The identity of the nematodes was confirmed as *D. filaria* based on the socks (boot)-shaped spicules in males and anterior knob in the larva (Dar *et al.,* 2012) (Fig. 3 and 4). The lavage from the tracheal mucus revealed the presence of larviparous egg of the lungworms (Fig. 5).

Table 1. Particulars of infected lambs with *Dictyocaulus filaria* infection (<1 year)

Year	No. of lambs housed	No. of lambs examined	*D. filaria* recovered lambs			% positivity
			Ram lambs	Ewe lambs	Total	
2012	327	51	-	1	1	1.96
2013	374	56	12	3	15	26.78
2014	365	55	3	7	10	18.18
Total		**162**	15	11	26	**16.04**

Table 2. Details of adult sheep with *Dictyocaulus filaria* infection

Year	Adult sheep housed	No. of adult sheep examined	*D. filaria* recovered adult sheep			% positivity
			Ram	Ewe	Total	
2012	686	38	-	4	4	10.52
2013	652	40	2	22	24	60.00
2014	859	53	-	1	1	1.88
Total		**131**	2	27	**29**	**22.13**

Fig. 1 and 2. Tracheal passage and section of lung showing the lungworm (*Dictyocaulus filaria*)

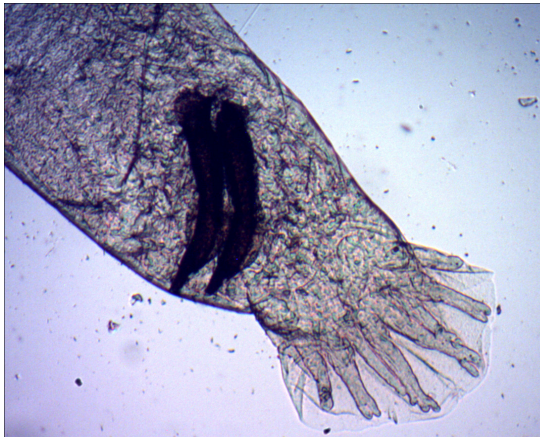

Fig. 3. Boot (socks) shaped spicules in the posterior end of the male lungworm (*Dictyocaulus filaria*)

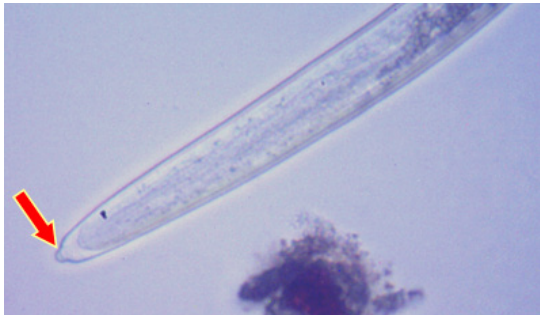

Fig. 4. The anterior knob of larva of *Dictyocaulus filaria*

Fig. 5. Larvated egg of *Dictyocaulus filaria*

The main mode of transmission is through ingestion of contaminated pasture and, as the protective immunity develops in adults after exposure, the infection is more common in young animals during their first grazing season. Mainly lambs of 4 – 6 month old are more commonly infected than adults (Tewodros, 2015). Major outbreaks are seen from July to September, when susceptible lambs are on pasture and the parasites have had enough time to reproduce (Taylor *et al.*, 2007). In this sheep farm, the main lambing season falls during February – April, and only 5-10% and 60-75% of the ram lambs and ewe lambs, respectively are retained to replace the breedable stock and the surplus lambs were culled. After about 1½ months of age, the lambs were allowed to suckle the dam twice daily and exposed to grazing. Our report is also in accordance to Taylor *et al*. (2007) as the major incidence in lambs was recorded during June-September months in lambs. During these months the weaned lambs were solely maintained on pasture and stall feeding of concentrates. In the present investigation, *D. filaria* worms were recovered from postmortem of 26 lambs with the per cent positivity of 17.1.

In the present study, the per cent positivity for lungworm infection was reported as 22.13 in case of adult sheep. In domestic small ruminants, no significant difference was noticed in the prevalence of lungworm among the different sex of the animals. However, fewer studies reported slightly higher prevalence among ewes than in rams (Ibrahim and Godefa, 2012; Terefe *et al*., 2013). In this

study also, a higher incidence of *D. filaria* was noticed in adult female (n=27) than in rams (n=2). This might have been due to production and reproduction stress in adult ewes resulting in immunosuppression. Whereas in lambs (< 6 months old) a greater number of male lambs shown positivity than ewe lambs (Table 1). The rationale behind the difference could not be ascertained.

The prevalence of lungworms is different based on geographical region and climatic factor. The distribution of *D. filaria* depends mainly on pasture contamination by carrier animals. The pasture infectivity in turn is related to rainfall which stimulates the activity of the larvae (Adem, 2016). Moisture is crucial for the survival and development of the larva that is active at moderate temperature of 10-21°C. The larva of lungworm survives best in cool, damp surroundings and under optimum conditions as it can persists for more than a year (Tewodros, 2015). The study area is also located in such climatic conditions (Prabhu *et al*., 2019). This could have provided the optimum conditions required for the survival of the larvae.

The prevalence rate of 13.4% to 53.6% has been recorded from various parts of Ethiopia by several authors (Alemu *et al.,* 2006; Ibrahim and Godefa, 2012; Adem, 2016). Further, the prevalence is low in spring and summer and rises rapidly in the autumn and winter. Overcrowding in sheds, undersupplied feeding and poor nutrition, concurrent infections usually predispose to lungworm infection (Borji *et al*., 2012; Tewodros, 2015). In our study, though the infection was present throughout the year, the clinical illness was pronounced in dry summer (n=23) and heavy rainy seasons (n=19). In the study area summer follows severe winter, during which sheep were maintained in a poor pasture. This could have been the reason for deficient feeding and a greater number of cases in summer. The summer in turn is followed by southwest monsoon which provides ambient temperature for larvae survival. Further, during this period of investigation, the incidence of *Oestrus ovis* was also recorded in the farm with peak incidence in southwest monsoon (Prabhu *et al.,* 2019). This concurrent infection could have also resulted in stress and might have aggravated the severity of lungworm infection. Hence, the per cent positivity could have been high during summer followed by rainy season of south west monsoon.

The control and prevention of lungworms in sheep mainly involves pasture management to minimize the exposure of lambs, elimination of intermediate host and by treating with anthelmintic drugs. Particularly benzimidazoles, levamisole and ivermectin were reported to be effective (Tewodros, 2015). Further, in places of United Kingdom and Western Europe, an irradiated larval vaccine was also been used. In the current situation, the herd was dewormed with levamisole hydrochloride @ 7.5 mg/ kg body weight and an additional dosing was given at 21 days interval. Thus, it is concluded that preventive measures by way of deworming the animals after proper screening could be taken to avoid the economic loss from mortality due

to lungworm infection and further production loss.

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