Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2017; 5(3): 1284-1287

Received: 27-03-2017
Accepted: 28-04-2017

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Occurrence and pathology of *Haemonchus contortus* infection in Goats

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Abstract
The present communication deals with the occurrence and pathology of *Haemonchus contortus* infection in goats. During 2001 to 2015, a total of 510 goats were necropsied in the Department of Pathology, CVSc, AAU, Khanapara, and out of these, the mortality in 84 (16.47%) were diagnosed as Haemonchosis. The effect of age, breed, sex and season on the occurrence of Haemonchosis were studied. Mostly observed gross lesions include generalized oedema, anaemia, and presence of fluid in the body cavities. The abomasal contents were fluidal and sometimes mixed with free blood with large number of adult *Haemonchus contortus* parasites. Ulcerative haemorrhagic spots were seen on the abomasal mucosa where the parasites were found adhered, with hyperaemia of the abomasal folds. Microscopical examination of the abomasum revealed extensive haemorrhages in the mucosa and submucosa with infiltration of eosinophils and mononuclear cells. In some cases there was hyperactivity of the goblet cells leading to occlusion of the glandular lumen

Keywords: Goat, *Haemonchus contortus*, pathology

1. Introduction
Parasitic infestation exerts adverse effects on the health and productivity of the livestock. The effects are varied and more pronounced in sheep and goat compared to those seen in other species of livestock [1]. Amongst the parasitic diseases, endoparasites have greatest importance in sheep and goat. Haemonchosis, an important gastrointestinal nematodiasis is prevalent wherever sheep and goats are raised, but produces the greatest economic loss in temperate climate. The blood sucking parasite *Haemonchus contortus* which is found in the abomasum of the sheep and goat causes significant blood loss. Each worm sucks 0.05 ml blood per day so that sheep/ goat with a total of 500 nos. of *Haemonchus contortus* may suck about 250 ml/ day resulting anaemia, loss of body weight and wool growth [2]. Thus, it can reduce productivity and can lead to death in infected animal.
The geo-climatic condition of Assam is conducive for the optimum growth and multiplication of this parasite, posing a challenge to the farmers as well as veterinarians. The aim of the present study was to record the occurrence and pathology of *Haemonchus contortus* infection in goats.

2. Materials and Methods
2.1 Study area: The study area is under the Kamrup (Metro) District of Assam situated at 26°6'N, 91°34'E, 72 m above the sea level. Climatically, the region is humid with hot subtropical summer and receives an annual rainfall of about 1722 mm. The temperature is highest during June- August. During summer, the maximum temperature is about 31.9 ^{0}C and minimum temperature is about 25.2 ^{0}C. Relative humidity is lowest during March (53%) and highest in July (83%). The meteorological data were collected from the Regional Meteorological Centre, Barjhar, Guwahati. One calendar year is divided into four seasons' viz. Pre monsoon (March- May), Monsoon (June- September), Post monsoon (October- November) and winter (December - February).

2.2 Animals: A total of five hundred ten (510) goats of both sexes were necropsied during 2001-2015 in the Department of Pathology, College of Veterinary Science, Assam Agricultural University (AAU), Khanapara. The age of the goats were divided into four (4) groups viz. Group I: 0-3 months, Group II: 3-6 months, Group III: 6-9 months, Group IV:

above 9 months. The breed/ genetic groups included in the study were Assam Hill goat (AHG), Beetal (B) & Cross (C) between Beetal & Assam Hill Goat.

2.3 Pathological studies: To study the pathology of Haemonchosis, the history/ clinical signs provided by the owner/ Farm Manager were recorded. During post-mortem examination, visible gross lesions were recorded and representative tissue samples were collected in 10 % formalin solution and processed for histopathological examination as per the standard method [3]. Adult worms were also collected from abomasum in normal saline and identified based on the morphological characteristics [4].

2.4 Statistical analysis: The factors affecting the occurrence of Haemonchosis viz. Age, breed, sex & season were analysed by using appropriate statistical methods as described [5].

3. Results and Discussion

During the period of study, a total of 510 nos. of goats were necropsied in the Department of Pathology, CVSc, AAU, Khanapara, and out of these, 84 (16.47%) were found died due to haemonchosis. A higher incidence i.e 31.10% and 53.34% of *Haemonchus contortus* infection in goats were reported by Raza *et al*. [6] and Singh *et al*. [7] respectively. A variation in the parasitic infestation depends upon difference in agro-climatic conditions and availability of susceptible host [8].

The percentage of Haemonchosis was highest (45.90%) in group IV animals followed by Group III (26.23%). Test of proportion (Z- value) revealed significant difference ($P<0.05$) between the age group of I & IV, II & III, II & IV and III & IV. This result has been in contrary to the earlier report [9], where it was reported that age had no significant influence on the occurrence of Haemonchosis, whereas Roth and Russel [10] reported higher mortality in lambs and kids.

The sex-wise percentage was found to be higher in the female (59.01%) in comparison to the male (40.98%). Test of proportion (Z- value) also revealed significant difference ($P<0.05$) between sexes. Higher rate of nematode infection in the female host as compared to the male was reported earlier [6,11] but not in agreement with the observation of Sabbas [9]. In the present study, higher prevalence of infection in the females compared to males might be due to lowered resistance of female animals on the part of their reproductive events and insufficient/ unbalanced diet against higher need.

Amongst the breeds/ genetic groups, the highest percentage was recorded in the Beetal (49.18%) followed by Crossbred (31.14%) and Assam Hill Goat (19.67%) respectively. Test of proportion (Z- value) also revealed significant difference ($P<0.05$) in between AHG & B and B & C. Differences in susceptibility of *Haemonchus contortus* are greater between breeds due to the relative ability to elicit an immune response [4]. Lowest incidence rate in Assam Hill Goat could be due to the higher disease resistance capacity of the indigenous animals.

In the present investigation, highest percentage (54.09%) was recorded in monsoon followed by pre-monsoon (18.03%), winter (16.39%) and post-monsoon (11.47%) respectively. Test of proportion (Z- value) revealed significant difference ($P<0.05$) in mortality between premonsoon & monsoon, postmonsoon & monsoon and winter & Monsoon. Earlier also highest incidence of *Haemonchus contortus* infection in monsoon, which was followed by post monsoon, pre monsoon and winter season respectively in an organized farm of Assam based on the faecal analysis by egg per gram (EPG) [12]. The highest mortality in monsoon season might be associated with the climatic condition of that particular period, which was favourable for the development of the eggs. Durani *et al*. [13] also reported highest incidence of Haemonchosis in July / August, who explained that presence of moisture favoured the development of the larvae, which was similar with earlier observation [14]. Heavy rainfall and high Relative Humidity (RH) lowers the resistance of the animals facilitating the larvae in establishing heavy infection. Moreover in winter the grazing hours of the animals are reduced which helps in reducing the chance of contact between the host and the parasite [15].

The carcasses were highly anaemic and the visible mucous membranes were pale to papery white in colour (Fig. 1). In most cases, the carcasses were emaciated. There was generalized oedema and presence of fluid in the body cavities (Fig. 2). All the visceral organs were pale. The abomasal contents were fluidal and sometimes mixed with free blood with large number of adult *Haemonchus contortus* parasites. In fresh carcasses the parasites were found swimming very actively. In few cases ulcerative haemorrhagic spots were seen on the abomasal mucosa where the parasites were found adhered, with hyperaemia of the abomasal folds (Fig. 3). Anaemia accompanied by hypoproteinaemia and oedema is the cause of death in Haemonchosis [4]. Presence of petechiae in the mucosa and hyperaemia of the mucosal folds of the abomasums were similar with the earlier observations [16].

Microscopic examination of all the abomasums revealed extensive haemorrhages in the mucosa and submucosa (Fig. 4). The inflammatory reactions consist mainly of eosinophils and mononuclear cells. In some cases there was hyperactivity of the goblet cells leading to occlusion of the glandular lumen. Denudated, stunted and necrosis of mucosa were also prominent in some cases (Fig. 5). Eosinophilic infiltration is in accordance with the earlier findings and considered to be an important element in response against *H. contortus* infection [17]. Denuded, stunted and necrosed mucosa might be due to damage caused by the more numbers of haematophagus *H. contortus* present in the abomasum and damage caused by the powerful chemicals released by the activated inflammatory cells [18].

Fig 1: Pale mucous membrane of the affected animal.

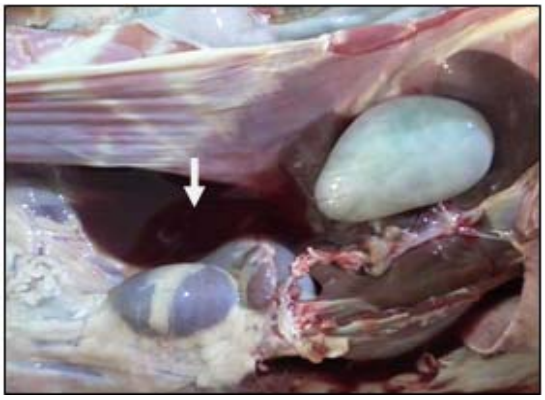

Fig 2: Accumulation of fluid in the body cavity.

Fig 3: Hyperaemia of the abomasal folds and presence of *H. Contortus.*

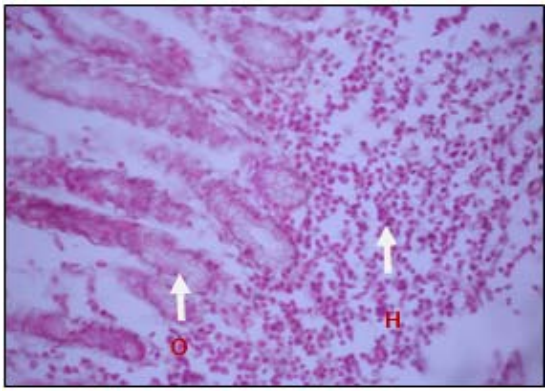

Fig 4: Photomicrograph of abomasums showing extensive haemorrhages (H) with occlusion of the goblet cell (O). H&E x400.

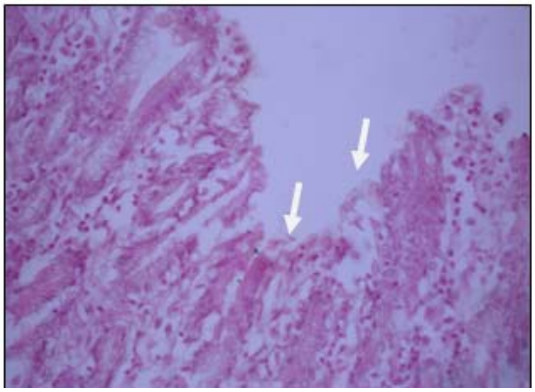

Fig 5: Photomicrograph of abomasums showing stunted and necrosed mucosa, H&E,x400.

5. Conclusion

The overall mortality due to Haemonchosis in the area surveyed could be attributed to the low lying location of the farms and insufficient grazing land in relation to the stock density. Keeping in view some control measures for gastrointestinal parasites can be undertaken to reduce the intensity of parasitic infection. Moreover, the strong influence of season is a favourable factor to be considered for taking the prophylactic measures. During rainy season, factors like temperature and humidity are suitable for the development and survival of the parasite. It is therefore suggested that anthelmintic treatment on quarterly basis may be implemented to lower down the parasitic load as well as mortality.

6. Acknowledgement

The authors are thankful to the Dr. J. Hussain, Assistant Professor, Department of L.P.M., College of Veterinary Science, AAU, Khanapara, for helping in statistical analysis of the data.

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