AN OVERVIEW OF GASTROINTESTINAL NEMATODE PARASITISM IN GOATS IN THE DRY ZONE OF SRI LANKA

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ABSTRACT

Gastrointestinal nematode infection is recognised as one of the major constraints in the development of the goat industry in Sri Lanka, particularly in the dry and intermediate zones of the country where over 65 per cent of the total goat population is distributed. This paper reports on three investigations carried out simultaneously to obtain relevant epidemiological data to formulate an effective chemoprophylactic programme to control the infection.

A total of 218 gastrointestinal tracts of goats from the dry zone were examined at necropsy to determine the prevalence of the nematode infection and the species of nematodes, which affected the animals. Two hundred and seventeen (99%) of the animals examined were infected with at least one or more species of gastrointestinal nematodes. The species identified included *Haemonchus contortus*, *Trichostrongylus colubriformis*, *Oesophagostomum columbianum*, *Trichuris ovis* and *Bunostomum phlebotomum*. The most prevalent species was *O. columbianum* while *H. contortus;* a pathogenic nematode of the abomasum (glandular stomach) was present in 81% of the animals. Although, clear dry and wet seasons were evident in the areas from where the animals were brought, a seasonal pattern of the mean total worm burden was not observed.

The faecal egg counts (EPG), of 218 goats and the worm burdens of the tracer animals were used to investigate the pattern of the natural gastrointestinal nematode infection of goats of the North Central Province of Sri Lanka. In this study, the EPG increased significantly from August to reach a peak during November. The lowest counts were recorded in June. Further, the trend in EPG counts matched the rainfall pattern in the experimental area. This field study also showed a peak EPG during October/November and it coincided with the increase in gastrointestinal nematodes in tracer kids indicating a distinct seasonality in which high EPG occurred during October/November and low counts were present during the months from May to July when the climatic conditions were dry. This finding suggests that gastrointestinal nematode infection is related to the rainfall. Three genera of adult nematodes, namely *H. contortus, T. colubriformis* and *O. columbianum,* were present in the area under study. *H. contortus* was the predominated species.

Furthermore, the effectiveness of three commercially available anthelmintics belonging to benzimidazole and imidathiazole classes were evaluated in goats in order to select the most cost-effective anthelmintic for a chemoprophylactic programme. All anthelmintics tested were equally effective, but pyrantel pamoate was found to be most cost-effective.

These observations serve as a useful guide for the control of gastrointestinal nematodes in the goats in the dry zone of Sri Lanka. Based on these findings it is recommended that an effective anthelmintic treatment just prior to the beginning of the monsoons followed by 1-2 repeated anthelmintic administrations at 3-5 weeks interval during the monsoon would effectively control the infection and minimise the accumulation of infective larvae in the pasture.

INTRODUCTION

Goat husbandry constitutes an important livestock enterprise among rural farmers of most developing countries of the tropical and subtropical regions of the world (Devendra and Burns, 1983). In Sri Lanka, more than 65 per cent of the estimated population of 500,000 goats are managed under an extensive system by rural, subsistence farmers, particularly in the dry and intermediate zones of the country (Sri Lanka Livestock Statistics 1991/92). The animals from these areas are a major source of meat that is consumed in urban and suburban areas while a few animals are used for milk production. Animals in the dry and intermediate zones are generally managed in herds consisting of 100 to 200 animals, but the income generated for these large herds are marginal because of the effects of diseases, poor nutrition and management constraints (Hariharan and Ravindran, 1992). In common with other countries of the tropics, gastrointestinal nematode parasitism is identified as major constraint to goat farming in Sri Lanka and a recent workshop on research priorities highlighted the importance of gastrointestinal parasitism as an area which required investigations in order to minimise the losses caused through morbidity and mortality (GTZ – CARP Agricultural Research Management Project, 1994).

Seneviratna (1955) reported the presence of several species of gastrointestinal nematodes in goats, but no systematic study has been carried out to determine the prevalence of the various species, which inhabits the alimentary tract. In this paper we describe the prevalence of species of nematodes recovered from gastrointestinal tracts of goats slaughtered at an abattoir and the observations recorded during a field study of gastrointestinal parasitic infections conducted in the dry zone. The results of a treatment trial conducted to determine the effect of commonly used anthelmintics is also described.

MATERIALS AND METHODS

Abattoir study (Public slaughter house study)

The abattoir survey was conducted at the Colombo Municipal abattoir from January 1996 to February 1997. During the period of study, a total of 218 gastrointestinal tracts were collected and examined for parasites as described by Hansen and Perry (1994).

Field study

A field study was conducted in two adjacent goat farms (150 animals in each herd) in Kekirawa in the North Central Province to determine the worm burden of the herd during a 12 months period (May, 1996 to April, 1997). In each farm, 100 animals between 4 and 24 months of age were selected for this study. Faecal samples collected during each month were assessed for faecal egg counts (egg per gram of faeces; EPG). In addition, two tracer animals were used during each month to evaluate the pasture larval density.

The animals in both farms were managed under an extensive system where the goats are allowed to browse on communal grasslands and shrub jungles for around

5 to 6 hours during the day and housed at night in sheds which had a raised slatted floor. No supplementary feed was provided.

Treatment trial

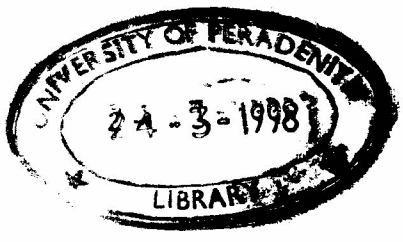
A total of 72 (4-24 months; 7-15 kg body weight) crossbred goats from 5 farms in Kekirawa were selected for a treatment trial to assess the efficacy of commercially available anthelmintics. The animals included in the trial had never received any anthelmintics during their lifetime and the faecal egg count exceeded 500 EPG. Based on the faecal egg counts, the goats were divided into 6 equal groups in a manner, which ensured that the mean EPG of each group was similar. Two groups were given two albendazole preparations *viz.* Alzole® and Valbezan® at a dose rate of 5-mg/kg-body weight. One group was given a double dose (10 mg/kg body weight) of albendazole (Valbezan®). Two groups were given levamisole (Nilverm®; 7.5-mg/kg body weight) and pyrantel (Combantrin®; 25-mg/kg-body weight), respectively. Except for the group, which received a double dosage of albendazole, all other treatment doses were computed as described by the manufacturers for sheep; no instructions were provided for goats. An untreated group of animals was used as a control.

The efficacy of the anthelmintics were assessed by the Faecal Egg Count Reduction Test (FECRT) and interpreted according to the guidelines stipulated by the World Association for the Advancement of Veterinary Parasitology (Wood, *et al.* 1995).

RESULTS

Abattoir study

Two hundred and seventeen (99%) of the animals examined were found to be infected with at least one species of gastrointestinal nematode. The species of nematodes identified included, *Haemonchus contortus, Trichostrongylus axei, Trichostrongylus colubriformis, Oesophagostomum columbianum, Trichuris ovis M. Benedine, S. Papillosus and Bunostomum phlebotomum*. The prevalence of each species of nematode is illustrated in Figure 1. *Oesophagostomum columbianum*, a nematode which inhabits the large intestines of goats was found to be the most prevalent species (88%) while *Haemonchus contortus,* a pathogenic nematode of the abomasa was present in 179 (65%) of the animals. The prevalence of parasite species during the 12-month period did not vary despite a clear wet and dry climatic conditions in the areas from where the goats were brought.



Field study

The overall mean EPG and rainfall pattern during the 12 months period under investigation is illustrated in Figure 2. The lowest level of EPG was present during June and July, followed by a clear trend in which an increase of EPG counts were observed until it reached a peak in November.

Tracer animal study

Pasture larval densities determined using by tracer animals indicated a minimal worm burden during the months from May to July while moderate levels were observed during August and September. During the months of October and November high pasture larval distributions were observed. *Haemonchus contortus* was found to be the most prevalent gastrointestinal nematode species-affecting goats in the area under study. The results from December 1996 to February 1997 were not obtained as the tracer animals could not be examined at necropsy. The distribution of nematodes present in the gastrointestinal tract of tracer animals is shown in Table 1.

Treatment trial

The results of the treatment trial are given on Table II. This study indicated that all the anthelmintics used were effective at the corresponding dose rates. However, when the cost of each treatment was evaluated against effectiveness, Pyrantel Pamoate was found to be most cost-effective.

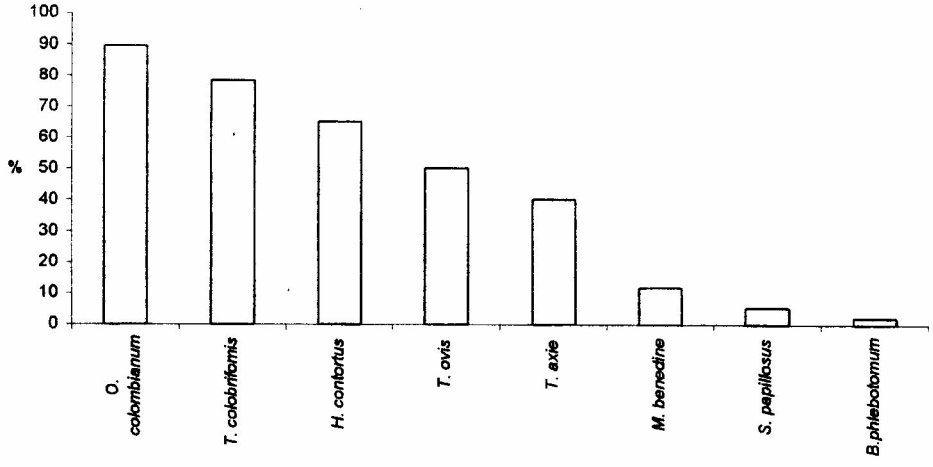


Fig. 1. Prevalence of nematode species in the gastrointestinal tracts of goats.

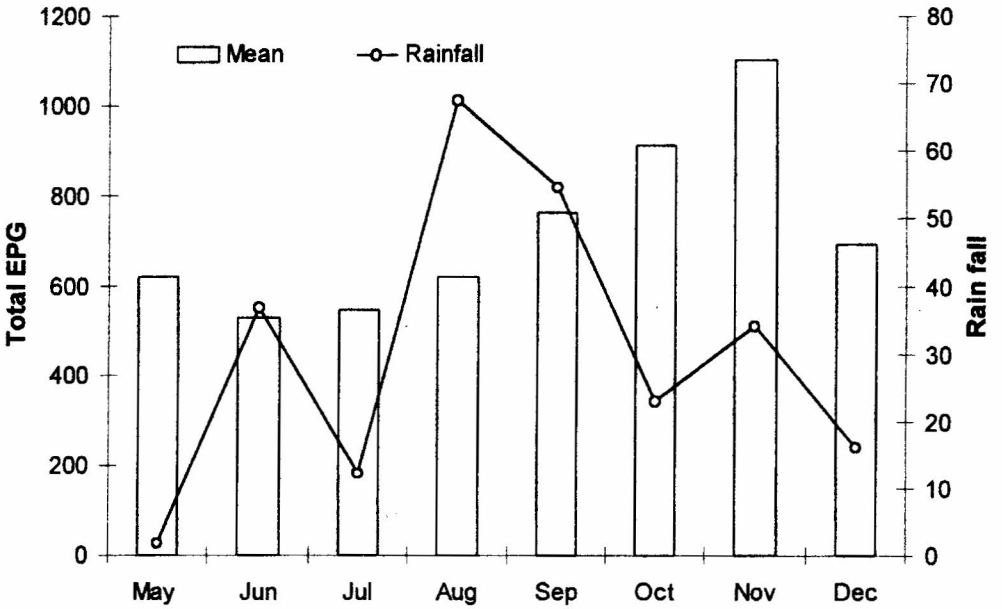


Figure 2. The total mean EPG during the study period in relation to the rainfall pattern.

Table I. The distribution of nematodes in the gastrointestinal tract of tracer animals. (The values indicate the average of number of parasites in the two tracer animals examined each month.)

Month	*Haemonchus*	*Trichostrongyl us*	*Oesophagosto mum*	*Trichuris*
May,1996	0	0	0	0
June	0	0	2	0
July	0	0	0	1
August	300	110	5	0
September	550	0	2	0
October	1450	200	74	0
November	2675	1325	127	0
December	ND	-	-	-
January,1997	ND	-	-	-
February	ND	-	-	-
March	1950	1360	36	0
April	2875	1450	28	0

ND – Not done

May 1996 to April 1997

Table II The efficacy of anthelmintics tested in the goat.

Group	Treatment	Pretreat. EPG	Posttreat. EPG	%FECR	CI
1	Alb(Alzole®),5mg/kg	817	33	96	95
2	Alb(Valbazan®),5mg/kg	675	17	97	97
3	Alb(Valbazan®),10mg/kg	741	25	98	96
4	Lev(Nilverm®),7.5mg/kg	900	9	99	98
5	Pyrantel, 25mg/kg	641	17	97	99
6	Control	617	725	-	-

%FECR – Percentage Mean Faecal Egg Count Reduction, Alb – Albendazole, Lev – Levamizole, CI – Confidence Interval

DISCUSSION

The species of gastrointestinal nematodes examined at necropsy revealed the presence of six species with a varying distribution. In a host check list published by Seneviratna, (1955) and Senadhira, (1967), a few more genera of gastrointestinal nematodes not included in this study were reported. These species include *Neoascaris, Mecistocirrus,* and *Cooperia.* In another study, Van Aken *et al.* (1990) reported the presence of only *Haemonchus* and *Oesophagostomum* species in an intensively managed goat farm in the North-western Province. The narrow distribution of parasites may be attributed to the frequent use of anthelmintics in the farm, which indeed may lead to the development of resistant strains of *Haemonchus* (Van Aken *et al.*, 1991).

The results obtained from 218 goat intestinal tracts examined at necropsy from the Colombo municipal abattoir, indicated that gastrointestinal nematode infection is a major disease entity in the goats managed extensively in the dry zone of Sri Lanka. The overall prevalence was 99% and an average worm burden of >1600 per animal. The number of abomasal worms reported herein is markedly higher compared to an average of 30 abomasal nematodes observed in Saudi Arabia (El-Azazy, 1995). The average total worm burden reported in this study is 1684, which is substantial and could be related to the management practices in the zone. The goats in this study have been managed under an extensive system in the dry zone where anthelmintic administration for the control of parasitism is minimal.

In the present study, *Haemonchus, Trichostrongylus* and *Oesophagostomum* were the most predominant genera encountered. However, Van Aken *et al.* (1990) noted that *Haemonchus* and *Oesophagostomum* to be the only genera of gastrointestinal parasites in the goats. The latter observation is similar to that by Jacquiet *et al.* (1995) in Mauritania and Vercruysse (1985) in Senegal. Rahman (1992) and Dorny *et al.*(1995) using faecal cultures also recorded *Haemonchus* and *Oesophagostomum* to be the most prevalent genera in goats.

Examination of the data obtained from tracer animals indicated *Haemonchus* to be the most common parasite involved. However, the contribution made by *Trichostrongylus* and *Oesophagostomum* is also found to be substantial according to the composition of the tracer worm burdens. Pasture larval challenge as measured by the tracer worm burdens indicate that minimum levels of infection during the period extending from May to September and moderate to high level of pasture contamination during October and November. Peak worm burdens were recorded in the month of April, 1997. This pattern of pasture contamination appears to be related closely to the pattern of rainfall where two peaks of larval contamination have been coincided with the peak rainfalls during the period. This could be explained by the fact that the formation of suitable microclimatic conditions that appears in times of rainfall is important in the development of pre-parasitic stages of parasitic nematodes in the pasture and it facilitates transmissions of these stages from faecal pat to the pasture (Michel and Parfitt, 1956). These peaks in the rainfall and pasture contamination, as indicated by the tracer worm burdens, mirrored the pattern of faecal egg counts in the animals, particularly used in this study in these farms. Since tracer worm burden estimation indicated minimum pasture contamination during the period from May to July, substantial faecal egg output in animals of the herds during that period could be related to the adult nematode population carried from the previous season (Jaquiet *et al.* 1995), resumed development of hypobiotic larvae (Jaquiet *et al.* 1995) or infection originated from pasture. Since studies carried out by Van Aken *et al.* (1990) and observations at the abattoir indicate that the phenomenon of hypobiosis was not a strategy of survival of gastrointestinal nematodes during the dry season, the substantial faecal egg counts in permanent animals in that period could entirely originate from adult nematode populations carried from previous season as no transmission of parasites was also observed in tracers in this period (Table 1). If any degree of infective larvae transmission had occurred during this period there would have been at least a minimal number of adult worms in the tracer animals examined during that period. This becomes very clear when the relationship between the rainfall and the presence of adult worms in the tracer animals are observed during the study period.

There were two major fluctuations in the mean faecal egg counts during the study period. It bears some relationship to the climatic factors, particularly the rainfall pattern in the study area. This contrast somewhat with observations made by Van Aken *et al.* (1990) in Sri Lanka and Dorney *et al.* (1995) in Malaysia, where they have observed no or very little relationship between faecal egg counts and rainfall. They have described their observations in relation to the less distinct seasonal pattern of rainfall leading to the persistency of larval contamination throughout the year or that the gastrointestinal nematodes could by pass detrimental dry environment persisting in the host. Since the study carried out by Van Aken *et al.* (1990) has been

based on the faecal egg counts only and has not been substantiated either by pasture larval counts or tracer worm burdens as methods to detect pasture larval availability, their observation does not reveal the seasonal availability of gastrointestinal nematode larvae in the pasture. The present study, on the other hand, observed the pasture larval challenge and suggests that the gastrointestinal nematode infection in small ruminants in the dry zone of Sri Lanka is seasonal. There was a minimal contamination from May to September and increase of infection thereafter is associated with an increase in moisture along with rainfall. Further, the observation of seasonality in gastrointestinal nematode infection in goats in the present study confirms observations made by Vercruysse (1985) in Senegal, Charles (1989) in Brazil and Rahman (1992) in Malaysia. Dry conditions have an adverse effect on the survival of free living stages on pasture and worms survive as adults and this was evident in the present study during May to September when pasture larval challenge was minimal and faecal egg counts were substantial. Comparatively higher rainfall has been recorded during August and September, which has favoured the pasture larval development. The larvae were recycled by the animals at the grazing land and was shown by higher faecal egg output during October and November. This resulted in a moderate increase in pasture larval challenge as indicated by the increase in tracer worm burdens during this period though rainfall was minimal. Another peak rainfall during February would have increased the pasture larval availability further.

CONCLUSIONS

Finally, some anthelmintics belonging to benzimidazole and imidathiozole classes were evaluated. The results obtained suggests that all tested anthelmintics were equally effective but pyrantel pamoate was found to be the most cost effective of all anthelmintics evaluated.

The most striking finding of the present study was the moderate to high gastrointestinal nematode infection can occur in the goats managed communally in the dry zone of Sri Lanka as evident by faecal egg counts and necropsy worm burdens. This emphasises the necessity of employing control measures against gastrointestinal nematode infection in the dry zone. While the present study does not provide a full understanding of the epidemiology of gastrointestinal nematode infection in this zone, some of the observations may help in designing control measures. Extensively managed goatherds who very often share the communal grazing lands, show quite similar infection patterns.

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