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# Epidemiology of Parasitoses in Dairy Animals in the North West Humid Himalayan Region of India with Particular Reference to Gastrointestinal Nematodes

K.P. Jithendran* and T.K. Bhat
*Indian Veterinary Research Institute, Regional Station, Palampur, H.P. 176 061, India*
**Correspondence*

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ABSTRACT

A systematic survey was conducted during two spells of 5 years each (1986–1990 and 1993–1997) to study the prevalence of parasitoses with particular reference to gastrointestinal (GI) nematodes and flukes in dairy animals (crossbred and native cattle, and buffaloes) belonging to 12 villages in the Kangra valley (Himachal Pradesh). Flukes (*Fasciola*, amphistomes and *Dicrocoelium*) and strongyles were the most important parasitic infections. *Fasciola* was endemic throughout the year, with a higher percentage infection in buffaloes than in cattle. Other fluke and nematode infections showed a seasonal pattern in prevalence, with a small peak in March–April followed by a high peak in July–September. The faecal egg counts (eggs per gram, epg) of flukes (*Fasciola*/amphistomes) ranged from 50 to 300 in cattle and 50 to 400 in buffaloes, with high loads during the rainy and post-rainy seasons. The GI nematode egg counts (excluding *Toxocara*) revealed a similar trend, with the overall monthly mean epg ranging from 85 to 1720 in cattle and 90 to 1625 in buffaloes, with a high peak during the months of July to September. On coproculture of positive samples, the nematode infections in order of prevalence were: *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Oesophagostomum*, *Bunostomum* and *Mecistocirrus*. The prevalence of most of the parasites was lower during the second 5-year period.

*Keywords:* buffalo, cattle, climate, control, epidemiology, *Haemonchus*, helminth

*Abbreviations:* GI, gastrointestinal; epg, eggs per gram

## INTRODUCTION

India has a population of 200 million cattle, 76 million buffaloes, 110 million goats, 46 million sheep and 275 million poultry, besides other livestock populations reared in diverse agroecological zones (Anon., 1997). Helminth parasitism, especially GI parasitism, is one of the major health problems severely limiting the productivity of dairy animals. In spite of significant production losses, which may run into millions of rupees (Shah and Chaudhry, 1995), the problem is neglected because of its chronic and insidious nature (Sanyal, 1996). The diverse agroclimatic conditions, animal husbandry practices and pasture management largely determine the incidence and severity of various parasitic diseases in a region. Information on the epidemiological patterns of the parasitic diseases in the different agroclimatic zones of the country would provide a basis for evolving strategic and tactical control of these diseases. The present communication records such information for dairy animals in Kangra district of Himachal Pradesh, which lies in the North West Humid Himalayan Region.

## MATERIALS AND METHODS

### *Location and climate*

The state of Himachal Pradesh is located between latitude 30.4° N to 33.2° N and longitude 75.8° E to 79.1° E and the altitude ranges from 350 to 6975 m above mean sea level. The study was conducted in 12 villages at Palampur (latitude 32.6°N; longitude, 76.3 E; altitude 1290.8 m) in the Kangra District in the subhumid mid-hill zone of Himachal Pradesh. The mean monthly minimum and maximum temperatures vary from $5.0 \pm 0.9$°C in January to $20.4 \pm 1.2$°C in June and $14.7 \pm 1.8$°C in January to $29.6 \pm 3.4$°C in June, respectively. The average monthly rainfall ranges from a minimum of $26.5 \pm 29.4$ mm in October to a maximum of $655.2 \pm 175.8$ mm in August and the relative humidity from 35.8% in April to 77.6% in August.

### *Methodology*

Faecal samples from 2959 cattle (both indigenous and crossbred) and 537 buffaloes, collected or received for screening, were subjected to qualitative and quantitative examinations for GI parasites, during two spells of 5 years each, from 1986 to 1990 and 1993 to 1997. The animals were of various ages and belonged to individual farmers or private/government farms. Many farmers procure their animals in late gestation and sell them after they have ceased lactation, so the exact age, lactation and previous history of most of the subjects were not known. The faecal egg count (eggs per gram of faeces, epg) of nematode eggs (excluding *Toxocara* eggs) was determined by the modified McMaster technique (MAFF, 1984), while fluke (*Fasciola* and amphistome) egg counting was done as described by Soulsby (1982). A representative number of faecal samples were pooled in equal quantities and used for coproculture at 27°C. The infective larvae were harvested and used for larval identification (Soulsby, 1965). Meteorological data were collected from the Department of Agronomy and Agrometeorology of Himachal Pradesh Krishi Vishvavidyalaya, Palampur.

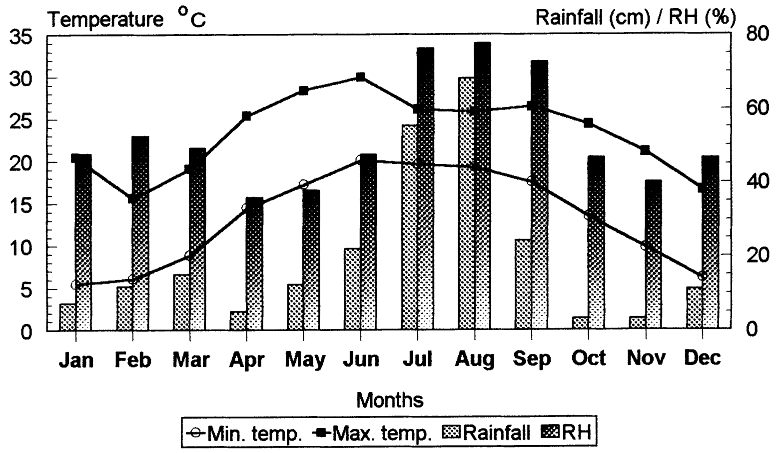
### *Statistics*

The data were analysed using the paired *t*-test and Duncan's multiple comparison test, and by one-way RM ANOVA using statistical software (SigmaStat, Jandel Scientific, USA). Values of $p < 0.05$ were accepted as significant.

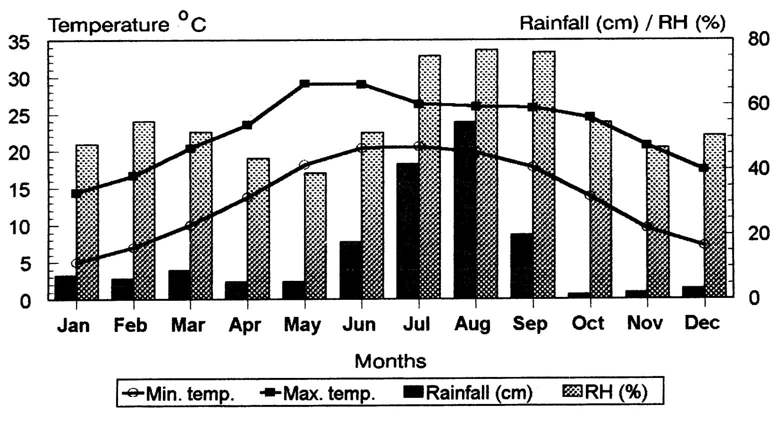
# RESULTS

*Meteorological data*

The meteorological data (rainfall, relative humidity, minimum and maximum temperature) of the study area, averaged for the periods 1986–90 (first phase) and 1993–97 (second phase) are shown in Figures 1a and b, respectively.




a




b

Figure 1. Meteorological data for Palampur (H.P.) during (a) 1986–90 and (b) 1993–97

*Prevalence and seasonal pattern of helminthoses*

Table I summarizes the percentage infection with helminth parasites in cattle and buffaloes during the study period. Of the 1552 cattle and 530 buffaloes examined, 1354 (87.2%) and 500 (94.3%) were found positive for various parasites, either singly or in mixed infections, during the first 5-year phase period (1986–1990), while the equivalent figures were 740 (52.3%) and 53 (50.5%) during 1993–1997, out of a total of 1407 cattle and 107 buffaloes.

TABLE I
Parasites in dairy cattle and buffaloes in Palampur, Himachal Pradesh

| | No. (%) infected[a] | | | |
|---|---|---|---|---|
| | 1986–1990 | | 1993–1997 | |
| Parasite | Cattle ($n = 1552$) | Buffalo ($n = 530$) | Cattle ($n = 1407$) | Buffalo ($n = 107$) |
| Flukes | | | | |
| *Fasciola* spp. | 559 (36.0) | 258 (48.7) | 88 (6.3) | 22 (20.6) |
| Amphistome spp. | 257 (16.6) | 81 (15.3) | 212 (15.1) | 12 (11.2) |
| *Dicrocoelium* spp. | 177 (11.4) | 99 (18.7) | 29 (2.1) | 2 (1.9) |
| *Schistosoma*. spp. | 9 (0.6) | 2 (0.4) | 0 (0.0) | 0 (0.0) |
| Cestodes | | | | |
| *Moniezia* spp. | 45 (2.9) | 15 (2.8) | 12 (0.9) | 2 (1.9) |
| Nematodes | | | | |
| Strongyle spp. | 487 (31.4) | 155 (29.2) | 190 (13.5) | 17 (15.9) |
| *Strongyloides* spp. | 142 (9.1) | 22 (4.2) | 24 (1.7) | 6 (5.6) |
| *Toxocara* spp. | 69 (3.9) | 24 (4.5) | 27 (2.1) | 2 (1.9) |
| *Dictyocaulus* spp. | 30 (1.9) | 3 (0.6) | 9 (0.7) | 0 (0.0) |
| *Trichuris* spp. | 81 (5.2) | 12 (2.3) | 21 (1.6) | 0 (0.0) |
| *Capillaria* spp. | 21 (1.4) | 6 (1.1) | 12 (0.9) | 0 (0.0) |
| Protozoa | | | | |
| *Eimeria* spp. | 141 (9.1) | 57 (10.8) | 97 (6.9) | 2 (1.9) |
| *Balantidium* spp. | 27 (1.7) | 3 (0.6) | 46 (3.3) | 0 (0.0) |
| *Cryptosporidium* spp. | 23 (1.5) | 11 (2.1) | 9 (0.7) | 6 (5.6) |

[a]Total numbers and total percentage of animals exceed expected values owing to multiple parasitism

The monthly prevalence of flukes (*Fasciola*, amphistomes, *Dicrocoelium* and *Schistosoma*) and strongyles in cattle and buffaloes during the study period is shown in Figures 2 and 3. In general, the second phase of the study revealed significant ($p < 0.05$) falls in the prevalence of flukes (except amphistomes) and strongyle infections in both cattle and buffaloes as compared to the first phase of the study, although the meteorological data revealed little difference between the two phases. Buffaloes had a significantly higher prevalence of infection with *Fasciola* and *Dicrocoelium* spp. than did cattle, while for other fluke and strongyle infections there was no significant variation between cattle and buffaloes in either phase. Monthly evaluation of the data further revealed that *Fasciola* was the most prevalent parasite in cattle and buffaloes throughout the year, in both periods, whereas all the other flukes and strongyles experienced two peaks, the first in February–March and the second in

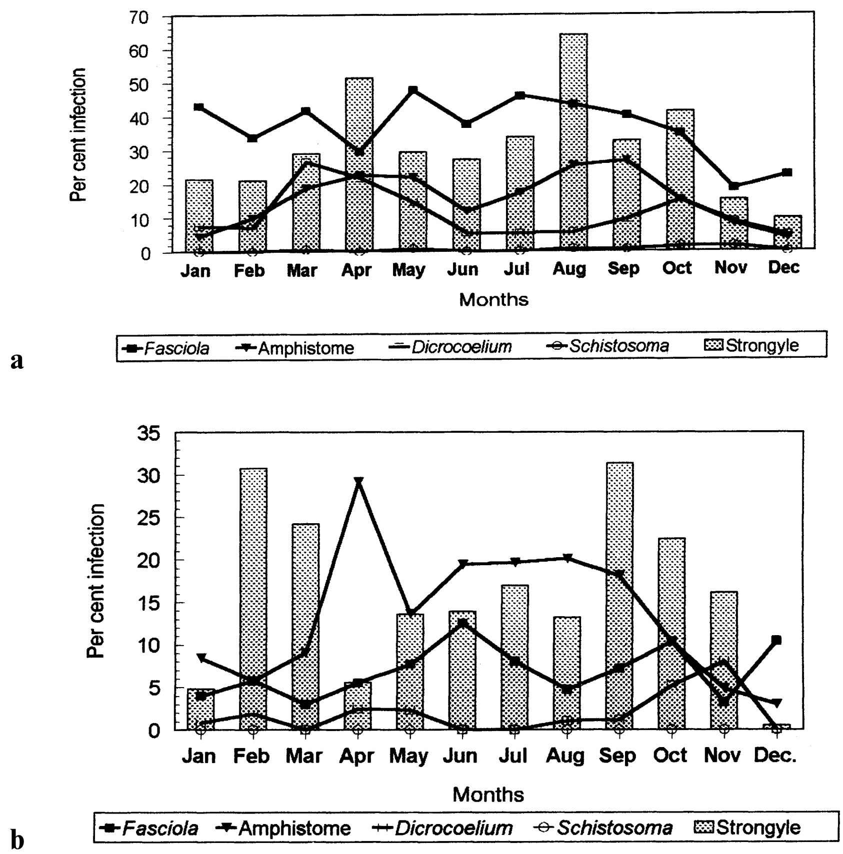



Figure 2. Monthly prevalence of fluke and strongyle infections in cattle during (a) 1986–90 and (b) 1993–97 (averaged over five years)

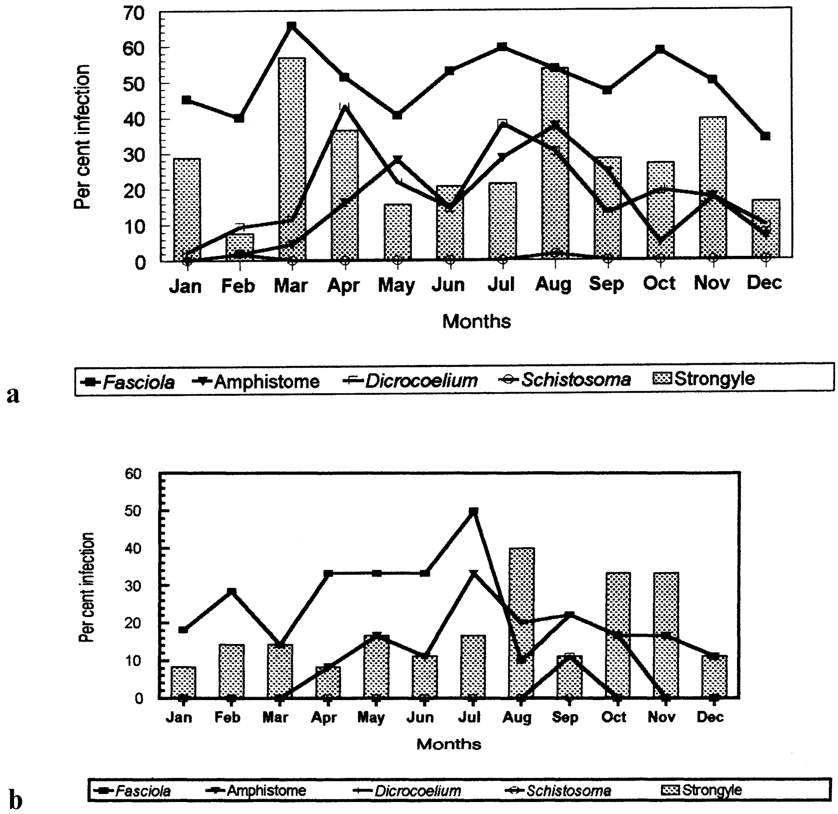



Figure 3. Monthly prevalence of fluke and strongyle infections in buffaloes during (a) 1986–90 and (b) 1993–97 (averaged over five years)

July–September. Among other GI parasites, *Toxocara* spp. and *Eimeria* spp. were important in young calves. Calves of dairy animals, especially buffalo calves, suffered seriously from *Toxocara* infection, leading to calf mortality. However, after detailed consideration this infection, which is primarily transmitted through the colostrum of infected mothers, was excluded from the present study.

## *Faecal egg count*

In the 227 positive samples subjected to faecal egg counts for *Fasciola* or amphistomes, the counts ranged from 50 to 300 epg in cattle and from 50 to 400 epg in buffaloes, with a high load during the rainy and post-rainy seasons. The prevalences of strongyles and *Strongyloides* spp. infections were high throughout the period of study, but the intensity in terms of epg and the composition of the major contributors to epg varied in different seasons. The monthly mean faecal egg count of GI nematodes (strongyles and *Strongyloides* spp.) during the study period ranged from 85 to 1720 epg in cattle ($n = 300$) and from 90 to 1625 epg in buffaloes ($n = 150$), with a high peak during the months of July to September (Figure 4). The difference in overall monthly mean nematode egg counts between cattle and buffaloes was not significant ($p > 0.05$).

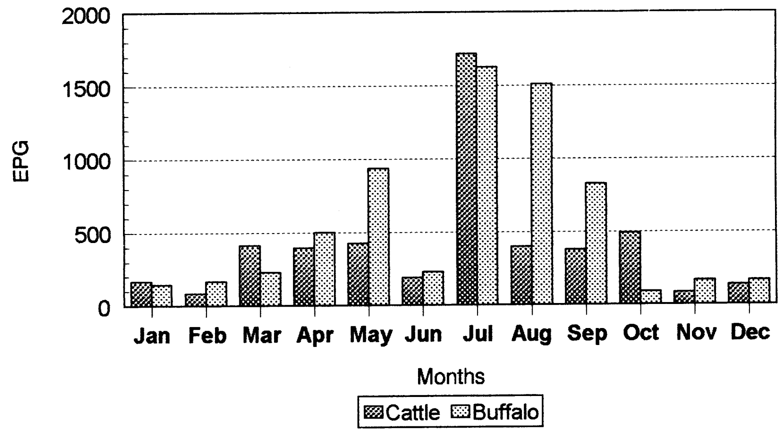



Figure 4. Nematode egg counts (epg) in cattle and buffaloes (averaged over two years, 1990 and 1993)

*Coprocultural studies*

Coproculture showed the presence of predominant nematode species of *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Oesophagostomum*, *Bunostomum* and *Mecistocirrus*, in decreasing order of prevalence. Larvae of *Strongyloides* and *Oesophagostomum* were observed throughout the year, while *Bunostomum* and *Mecistocirrus* were encountered occasionally.

## DISCUSSION

The National Dairy Development Board (Anand) conducted a nationwide survey of parasitic gastroenteritis in cattle and buffaloes during 1990–94 at nine localities in seven agroclimatic zones of India. However, this study did not cover the temperate Himalayan region, which is an important agroclimatic region of the country. The present communication records the information on epidemiological studies on helminthoses in dairy animals in this region. The occurrence and the seasonal prevalence of various helminth parasites have been reported earlier (Krishna *et al.*, 1989) but little attention was focused on nematodes and the intensity of infection. Recently, Chauhan and colleagues (1994) attributed 24.5% mortality and 40.0% morbidity to parasitic diseases (liver flukes, parasitic gastroenteritis, etc.) in various dairy farms in the Kangra valley.

The study area has been subjected to a continuous monitoring and surveillance programme for parasitic diseases since 1986, involving baseline data collection on animal husbandry practices, disease investigation and diagnosis and feedback to the farming community. A moderate decrease in parasitized animals in the study area was noticed over a period of 10 years. The reasons for the fall in infection rates between these phases could be the availability of effective anthelmintics and good management resulting from education and awareness created through popular literature in the vernacular language.

Only tactical dosing with flukicides was given to control fluke diseases and no drenching strategy was implemented in the region, although FAO (1994) recommended strategic dosing against fluke diseases in ruminants in India. During the first phase (1986–1990), the flukicides mainly used were carbon tetrachloride, hexachlorophene, hexachloroethane, and rarely triclabendazole, nitroxynil, and oxyclozanide, along with supportive therapy, while in 1993–1997 more effective anthelmintics such as albendazole, triclabendazole, oxyclozanide and closantel were used by local veterinarians for chemotherapeutic treatment of fluke-infected animals. Against nematodes, the main drugs in use during the first phase of the study were morantel citrate, piperazine citrate, thiabendazole and mebendazole, as against piperazine citrate, mebendazole, fenbendazole, albendazole, morantel citrate, levamisole, tetramisole and closantel during the second phase. There was no apparent indication of anthelmintic resistance in the study area.

Based on a nationwide survey on parasites epidemiology in dairy animals in seven different agroclimatic zones, Sanyal and Singh (1995) also indicated an increased parasite burden in the host and on pasture during the rainy seasons, the months for which vary in different agroclimates. The present study indicated the same trend, but the months differed owing to different climatic conditions and timing of the onset of monsoon in the region.

The south-west monsoon sets in July and ends in September, with the highest rainfall in August. The rise in strongyle epg (Figure 4) could be attributed to a more favourable temperature and humidity for the development and survival of the pre-parasitic stages (Durie, 1961), leading to increased availability of infective larvae on the pasture during the subsequent months. This study also indicated that, under normal conditions, the animals harboured a worm burden without any clinical signs, but that the worm burden reached a threshold pathogenic level during these monsoon and post-monsoon seasons. The egg count data revealed that July–September were the months with the highest risk of GI nematodosis and pasture contamination. Sanyal (1998) reported a strategic deworming schedule in Gujarat state against bovine parasitic gastroenteritis based on the seasonality of parasite prevalence. The present study suggests that broad-spectrum anthelmintic treatment of dairy animals at least twice a year, once in March–April and again in July–September should reduce the parasitism, and increase the productivity of animals in the region. Monitoring and surveillance are the key to the success of integrated parasite control and sustainable livestock production. Further studies on the epizootiology of GI nematodes, larval bionomics and pasture burden are required in high-altitude pastures for better understanding of GI parasitism and disease logistics in the region.

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**Epidémiologie de maladies parasitaires chez des animaux de production laitière dans la région humide du nord-ouest de l'Himalaya en Inde: étude particulière des nématodes gastrointestinaux.**

**Résumé –** Une étude fut menée pendant deux périodes de cinq ans (1986–1990 et 1993–1997) pour suivre la prévalence des maladies parasitaires, particulièrement des infections gastrointestinales dues à des helminthes et d'autres vers parasites chez des animaux laitiers (vaches de race croisée ou locale, buffles) appartenant à 12 villages de la Vallée du Kangra (Himachal Pradesh). Les vers parasites du groupe *Fasciola Dicrocoelium* ou des amphistomes et ceux du groupe des *Strongyles* furent parmi les parasites les plus nombreux. *Fasciola* fut isolé toute l'année mais avec un pourcentage plus fort chez les buffles que chez les bovins. Les autres infections parasitaires furent plutôt saisonnières avec un pic faible en mars–avril et un autre pic plus élevé entre Juillet et Septembre. Le nombre des kystes fécaux (epg) se situa entre 50 et 300 pour les bovins et entre 50 et 400 pour les buffles avec des taux élevés pendant la saison des pluies et celle qui lui succède. Le nombre des oeufs de nématodes gastrointestinaux (excluant le *Toxocara*) montra le même profile avec une moyenne mensuelle de l'epg entre 85 et 1720 pour les bovins et entre 90 et 1625 pour les buffles; les plus hautes concentrations étant rencontrées entre juillet et septembre. Après culture des prélèvements fécaux, les genres de Nematodes rencontrés furent par ordre d'importance: *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Oesophagostomum*, *Bunostomum* et *Mecistocirrus*. La prévalence de la plupart de ces parasites fut la plus faible pendant la deuxième période de cinq ans.

**Epidemiología de las parasitosis en ganado bovino en la región húmeda noroccidental del Himalaya de la India, con especial referencia a los parásitos intestinales**

**Resumen** – Un estudio sistemático fue realizado durante 2 períodos de 5 años (1986–1990 y 1993–1997) para determinar la prevalencia de las parasitotis, con especial referencia a helmintos y tremátodos gastrointestinales, en ganado bovino (vacuno cruzado y vacuno nativo, y búfalos) perteneciente a 12 poblaciones del valle de Kangra (Himachal Pradesh). Tremátodos (*Fasciola*, amphistomas y *Dicrocoelium*) y strongyles fueron las infestaciones más importantes. *Fasciola* fue endémica a lo largo de todo el año, con un porcentaje de infestación superior en búfalos que en vacuno. Otras infestaciones por tremátodos y por nemátodos mostraron un patrón de prevalencia estacional, con un pequeño pico en marzo–abril y un gran pico en julio-septiembre. Los recuentos fecales de huevos (epg) de tremátodos (Fasciola/amphistomas) variaron de 50 a 300 para el vacuno y de 50 a 400 paralos búfalos, coincidiendo los niveles más elevados con la estación de lluvias y el período posterior a las mismas. Los recuentos de nemátodos gastro-intestinales (excluyendo *Toxocara*) mostraron una tendencia similar, con un epg medio mensual de 85 a 1720 en vacuno y de 90 a 1625 en búfalos, con un gran pico durante julio-septiembre. En le coprocultivo de muestras positivas, las infestaciones por nemátodos fueron por orden de prevalencia: *Strongyloides*, *Trichostrongylus*, *Haemonchus*, *Oesophagostomus*, *Bunostomum* y *Mecistocirrus*. La prevalencia de la mayoría de estos nemátodos fue inferior durante el segundo quinquenio.