

# HELMINTH PARASITES - A CONSTRAINT IN ANIMAL HEALTH MANAGEMENT IN HIMACHAL PRADESH

**K.P. Jithendran**

*Indian Veterinary Research Institute, Regional Station, Palampur (H.P.) 176 061*

## 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 population reared in diverse agro-climatic conditions (Anonymous, 1997). Helminth parasitism, especially, gastrointestinal parasitism, is one of the major health problems severely limiting the animal productivity in dairy animals. In spite of significant production losses, which may run into millions of rupees (Shah and Chaudhry, 1995) the problem is neglected due to its chronic and insidious nature (Sanyal, 1998). The diverse agroclimatic conditions, animal husbandry practices and pasture management largely determines the incidence and severity of various parasitic diseases in a region. Epidemiological pattern 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 examines the status of helminth parasites in dairy animals and its management in Himachal Pradesh.

## MATERIALS AND METHODS

### Location, Geography and Climate

The state of Himachal Pradesh is located between the latitude 30.4° N to 33.2° N and longitude 75.8° E and 79.1° E and the altitude ranges from 350 to 6,975 m above mean sea level (m.s.l.). Agro climatically, the state is divided into 4 zones on the basis of temperature, rainfall and altitude (Fig. 1). The mean monthly minimum and maximum temperatures vary from 5.0±0.9° C in January to 20.4±1.2° C in June and 14.7±1.8° C in January to 29.6±3.4° C in June, respectively. The average monthly rainfall range from a minimum of 26.5±3.0 mm in October to maximum of 655.2±175.8 mm in August and the RH from 35.8 % in April to 77.6 % in August.

### Livestock resources

About 92 % population in Himachal Pradesh is rural and depends directly on agriculture, horticulture and animal husbandry (Anonymous, 1994). Rearing of livestock is an integral component of the economy of the state providing source of livelihood to most of the people, especially those inhabiting the border districts of Lahaul-Spiti, Kinnaur, Pangi and Bharmour sub divisions of Chamba and Bara Bangahal area of Kangra. In the remaining areas, livestock rearing is practiced generally within the framework of mixed farming. The state has a total livestock population of 50.93 lakh against total human population of 51.11 lakh living in 16,807 inhabited villages (Table. 1). The livestock population has been almost static during the last 10 years although the per capita daily milk availability increased from 191g in 1978 to 288g in 1989-90 (Chauhan, 1995).

### Methodology

The present study was undertaken as apart of monitoring and surveillance of animal diseases in Himachal Pradesh over a period of one decade. The domestic animals (cattle, buffalo, sheep and goats) were of various ages and belonged to individual farmers or private/Government farms. Faecal samples from these animals were subjected to qualitative and quantitative examinations for Gastro Intestinal (GI) parasites. The faecal egg counts (eggs per gram of faeces, EPG) of nematode 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 subjected to coproculture at 27° C and the infective larvae were harvested and used for larval identification (Soulsby, 1965). Meteorological data were collected from the department of Agronomy and agrometeorology of HPKV, Palampur. Statistical analysis was done using statistical software (SigmaStat, Jandel Scientific, USA). Values of  $P < 0.05$  were accepted as significant.

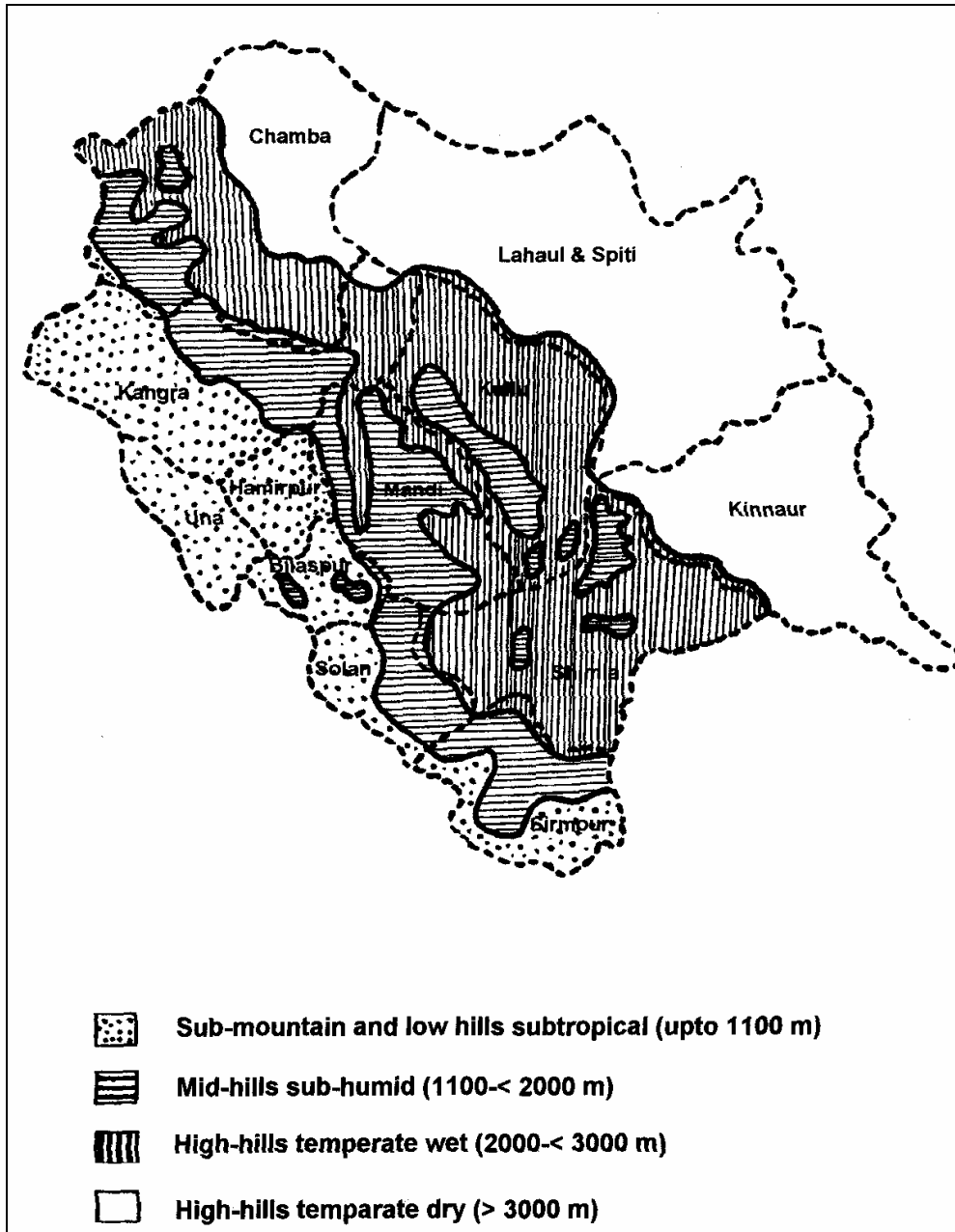


Figure 1. Agroclimatic zones of Himachal Pradesh

**Migratory grazing**

Western Himalaya is further characterized by the peculiar practice of migratory grazing. Some of the migratory graziers are *Gujers* and *Gaddis*. Abundant grazing facilities are available in the higher altitude pastures where as foothills are quite suitable for winter grazing. The migratory system, which was, ecosustained in the past has now yielded to the divesting resource pressures. The rising livestock population coupled with the shrinkage of pastures is threatening the migratory grazing in the western Himalayas.

**Table 1.** District wise livestock population in Himachal Pradesh (1992 census)

District	Cattle	Buffalo	Sheep	Goat	Dog	Others	Total	Poultry
Bilaspur	60,461	86,858	24,615	63,472	8,770	1,309	2,45,485	58,844
Chamba	2,38,988	34,832	2,58,490	1,75,268	14,730	2,800	7,25,108	67,871
Hamirpur	60,671	94,089	49,498	30,719	8,500	1,783	2,45,260	28,810
Kangra	3,98,558	1,47,386	1,55,432	2,05,024	32,448	10,544	9,49,392	2,42,681
Kinnaur	20,937	3	57,720	28,622	2,182	4,358	1,13,822	5,795
Kullu	1,57,448	670	1,09,835	56,382	9,062	1,379	3,34,778	21,315
Lahul & Spiti	8,910	-	42,766	11,445	205	3,405	66,731	4,923
Mandi	4,30,331	1,07,676	1,96,041	2,03,270	14,184	5,155	9,56,657	81,363

Shimla	3,29,055	23,258	1,26,531	95,831	16,469	5,866	5,97,010	45,082
Sirmaur	2,35,577	40,108	27,616	1,15,915	14,850	4,586	4,38,632	39,475
Solan	1,43,491	74,349	19,713	82,541	10,304	3,042	3,33,440	46,167
Una	67,209	91,694	6,088	47,100	13,731	826	2,26,648	21,776
H.P. (Total)	67,51,616	7,00,923	10,74,345	11,15,591	1,45,435	45,053	52,32,963	6,64,039

Source - Directorate of Economics and Statistics, Shimla (Himachal Pradesh), 1994.

**RESULTS AND DISCUSSION**

**Meteorological data**

The meteorological data (rainfall, relative humidity, minimum and maximum temperature) of the state is shown in Figure 2

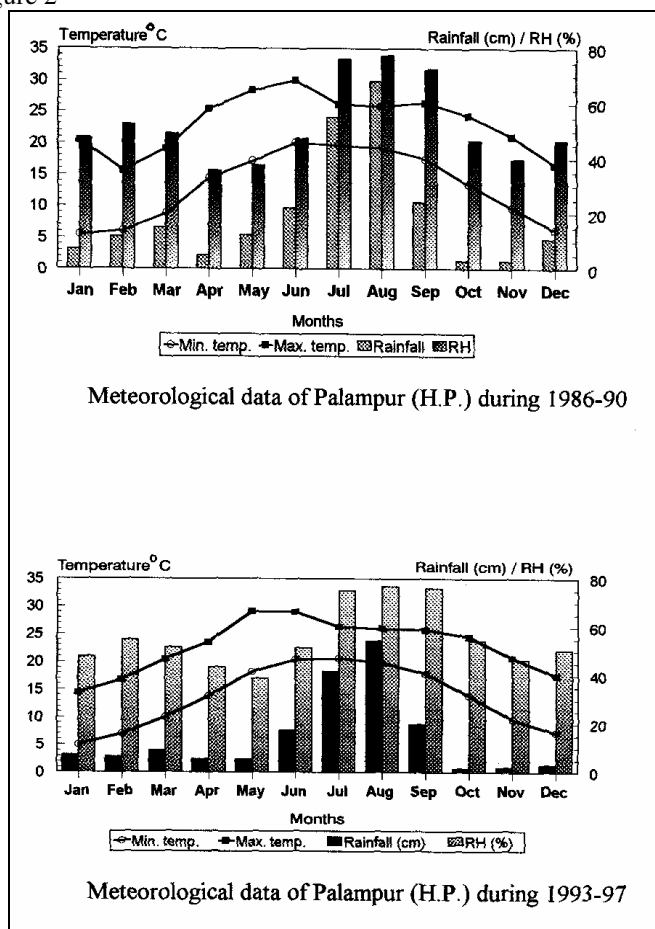


Figure 2. Meteorological data of two time-series

**Status of parasitic diseases**

In Himachal Pradesh, animals are kept in a variety of husbandry systems from a single cow kept for the family to large herds and flocks maintained in a range of systems. Transhumance over long distances, from the Punjab and to the alpine meadows of the inner Himalayas, is an established practice although is changing in the contemporary period. The traditional sheep and goat rearers called *Gaddis* are semi-nomadic, who practice large herding of sheep and goats from range to range and their flocks are migratory in nature through well defined routes (Figure 3) in Himalayan pasture (Bhasin and Singh, 1995; Chakravarti, 1998; Duffield *et al.*, 1998 and Berkes *et al.* 1998). These animals remain confined to the low plains in Zone I and II and border areas of Punjab during the winter season, but migrate to the alpine pastures (3000-4500 m above m.s.l.) in Zone III and IV during spring and summer seasons. The constant movement of flocks of sheep and goats over a large area ranging different states may greatly facilitate the spread of infection among livestock. Tables 2-4 present a checklist of most important helminth parasites observed in common livestock (cattle, buffalo, sheep, goat *etc.*) based on the studies conducted in Himachal Pradesh.

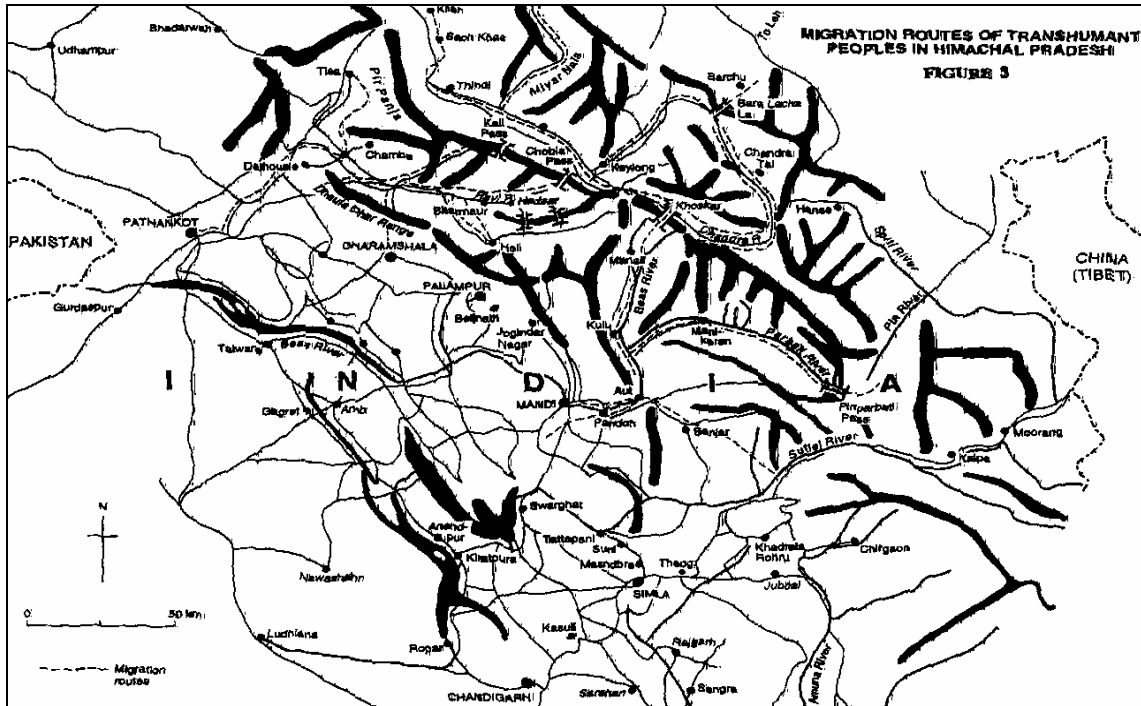


Figure 3. [Source Chakravarti, 1998]

**Prevalence and seasonal pattern of helminthoses in large ruminants**

Table 5 summarises the percentage infection of gastrointestinal parasites in cattle and buffaloes during the study period of two phases 1986-90 and 1993-98. Of the 1,552 cattle and 530 buffaloes examined, 1,354 (87.2 %) and 500 (94.3 %) were found positive for various GI parasites either singly or in mixed infections during 1986-1990 while, these figures were 716 (54.2 %) and 53 (50.5 %) during 1993-1997 out of a total of 1,320 cattle and 107 buffaloes. Figures 4-7 shows the seasonal prevalence of flukes and strongyles during different months in cattle and buffaloes during 1986-90 and 1993-97. In general, the second phase of the study revealed significant ( $P < 0.05$ ) fall 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 buffaloes had a significantly higher prevalence of infection with *Fasciola* and *Dicrocoelium* spp. than did cattle, while for other flukes and strongyle infections, there was no significant variation between cattle and buffaloes in either phase.

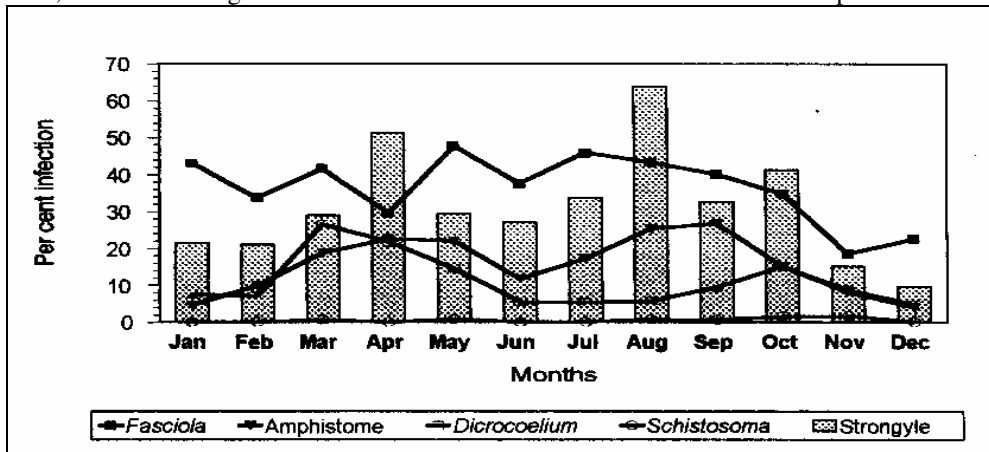


Figure 4. Meteorological data of Palampur (H.P.) during 1986-90

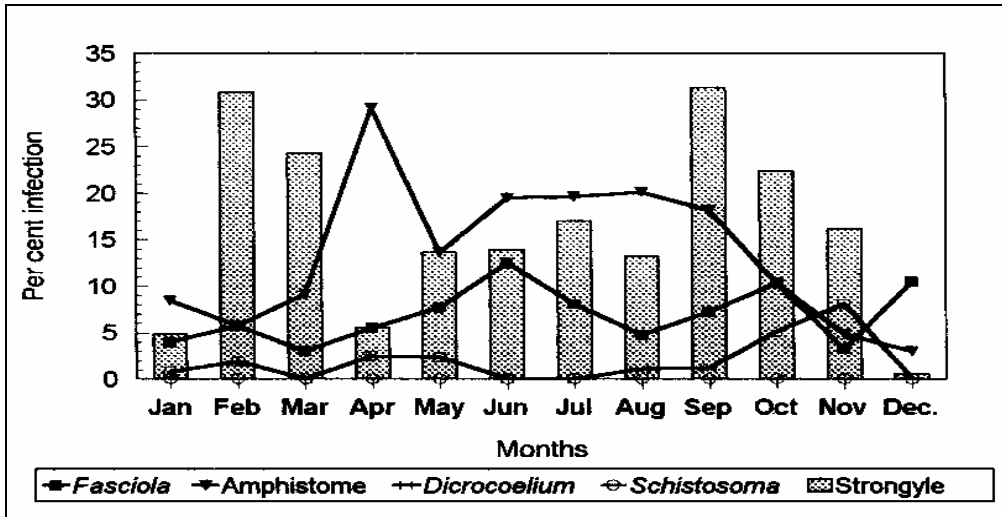


Figure 5. Meteorological data of Palampur (H.P.) during 1993-97

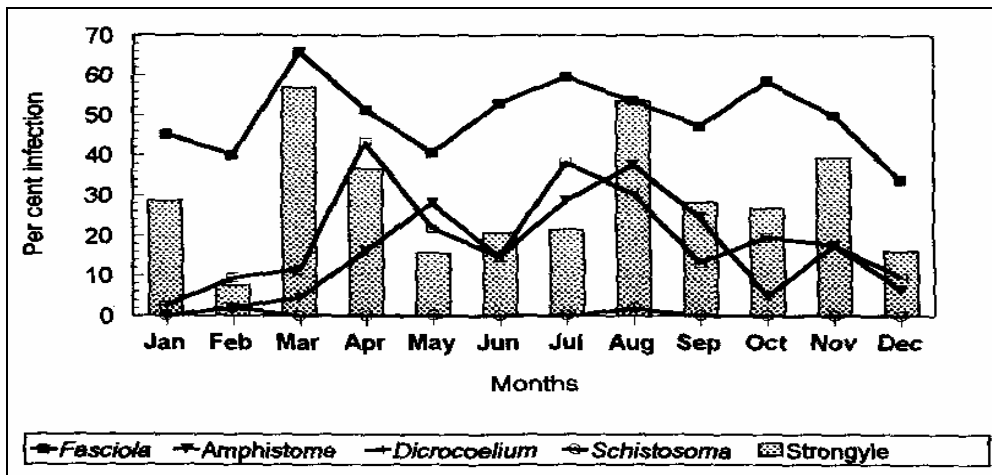


Figure 6. Monthly prevalence of fluke and strongyle infections in cattle during 1986-90 (averaged over five years)

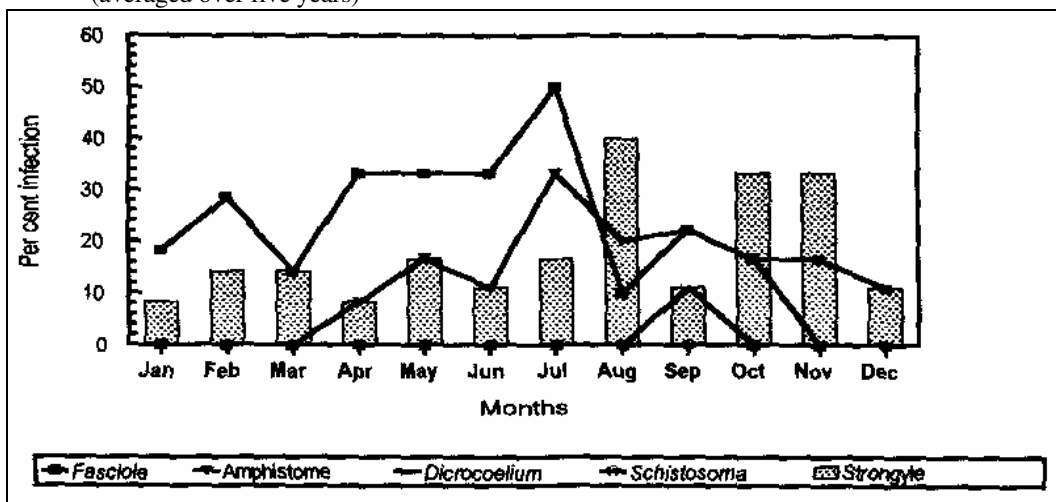


Figure 7. Monthly prevalence of fluke and strongyle infections in cattle during 1993-97 (averaged over five years)

**Faecal egg count:** The intensity of infection in terms of faecal egg counts for *Fasciola* and amphistome ranged from 50-300 EPG in cattle and from 50 to 400 EPG in buffaloes, with high load during the rainy and post-rainy seasons. The prevalence of *Strongyle* 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 counts of GI

nematodes (*Strongyle* and *Strongyloides* spp.) during the study period ranged from 85 to 1750 in cattle and from 90 to 1625 in buffaloes, with high peak during the month of July to September (Figure 8). The difference in overall monthly mean egg counts between cattle and buffaloes was not significant ( $P>0.05$ ).

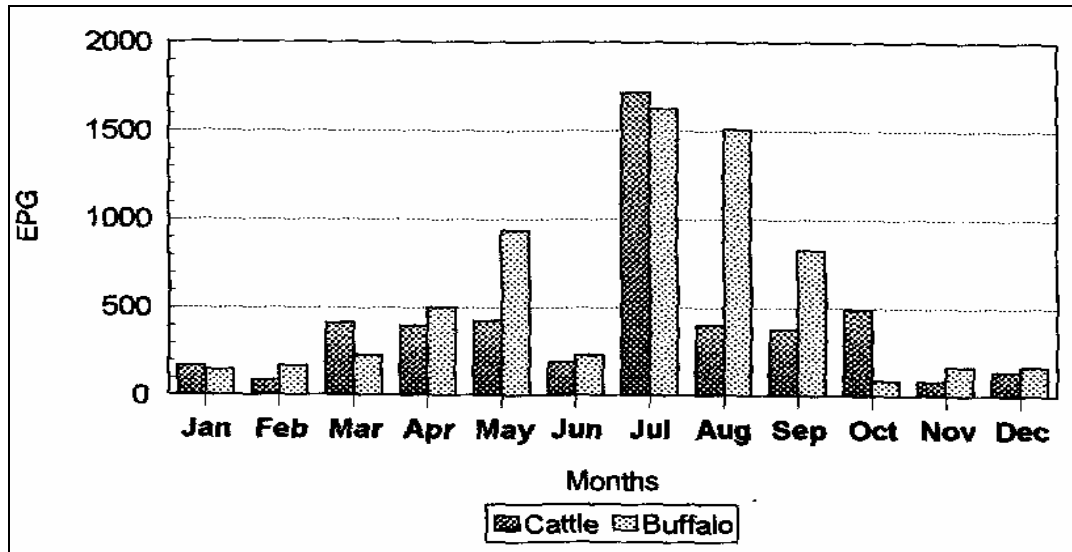
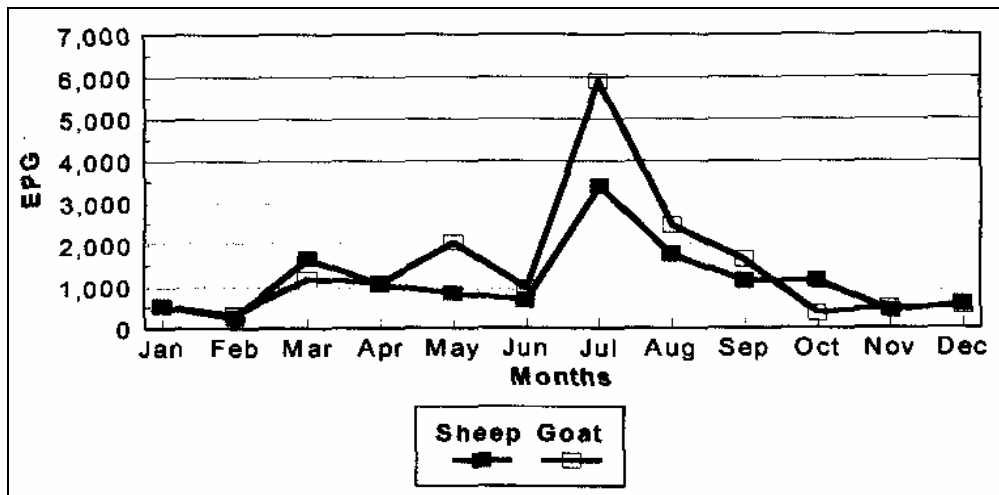


Figure 8. Nematode egg counts (EPG) in cattle and buffaloes (averaged over two years, 1990 & 1993)

**Coprological studies:** Coproculture showed the presence of predominant nematode species of *Strongyloides*, *Trichostrongylus*, *Haemonchus* and *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.

#### Prevalence and seasonal pattern of helminthoses in small ruminants

Parasitic infections among sheep and goats were again major constraints to profitable production (Table 6). *Fasciola* (liver fluke), *Amphistome* (stomach fluke), *Dicrocoelium* (lancet fluke) and *Schistosoma* (blood fluke) are the most important flukes recorded from the state. The snails act as intermediate hosts for these fluke (Jithendran and Krishna, 1990). *Strongyle* revealed 93 % infection either singly or in mixed with species of *Fasciola*, *Amphistome*, *Moniezia*, *Dictyocaulus*, *Trichuris* and *Eimeria* in various combinations. The mean monthly EPG of strongyle ranged from 236 to 3400 in sheep and 325 to 5908 in goats. With high peak during June to August mainly because of species of *Strongyloides*, *Trichostrongylus*, *Haemonchus* and *Oesophagostomum* besides *Bunostomum* and *Chabertia* occasionally. Figure 9 indicate that under normal conditions the animals do possess a certain degree of GI parasitism without any clinical symptoms but worm burden reaches to pathogenic level during monsoon and post-monsoon seasons. However outbreaks of parasite induced mortality occurred mainly in spring and autumn season in migratory flocks and many such outbreaks remain unnoticed due to the grazing of flocks in far-flung areas of Lahaul-Spiti, Chamba and Kangra districts. Non-synchronized breeding also poses problems due to exposure of young animals to heavy infection before they reach the lower plains resulting in seasonal outbreaks of various helminthic diseases.



**Figure 9.** Mean monthly strongyle fecal egg counts (EPG) in sheep and goats in Himachal Pradesh (year, 1990)

### CONTROL STRATEGIES

Livestock production offers a vast scope for development in Himalayan environment. Management of livestock is a specialized area based on knowledge, skill and dedication. An effective livestock and disease control programme is a key management operation. Animal health programmes vary mildly depending on the species of livestock, the climate and topography of the area. In migratory farming of a pastural system, the mortality losses due to diseases are generally lesser except in case of severe outbreaks of contagious diseases (Figure 10). However, parasitism is the single most entity for morbidity in livestock (Jithendran, 1998). Intelligent attention on management practices in hill areas is the need of the hour for sustainability of hill farming systems.

Only tactical dosing with anthelmintic is currently in practice and no drenching strategy has been implemented in the region. Fluke infection has been treated with halogen compounds of carbon tetrachloride and hexachloroethane, which were effective with varying side effects (Jithendran and Krishna, 1991). Hexachloroethane has been reported to reduce the incidence of fasciolosis infection in several villages in the mid-eighties (Mathur, 1986). The drugs currently in use to check flukes are albendazole, oxcylozanide, rafoxanide, nitroxylin, triclabendazole and closantel. Against nematodes, the main drugs in use during the last one decade were morantel citrate, piperazine citrate, thibendazole and mebendazole, fenbendazole, albendazole, levamisole, tetramisole, closantel and ivermectin compounds. The present study revealed that July-September were the months with the highest risk of GI parasites. 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 parasitism and increase the productivity of animals in the region.

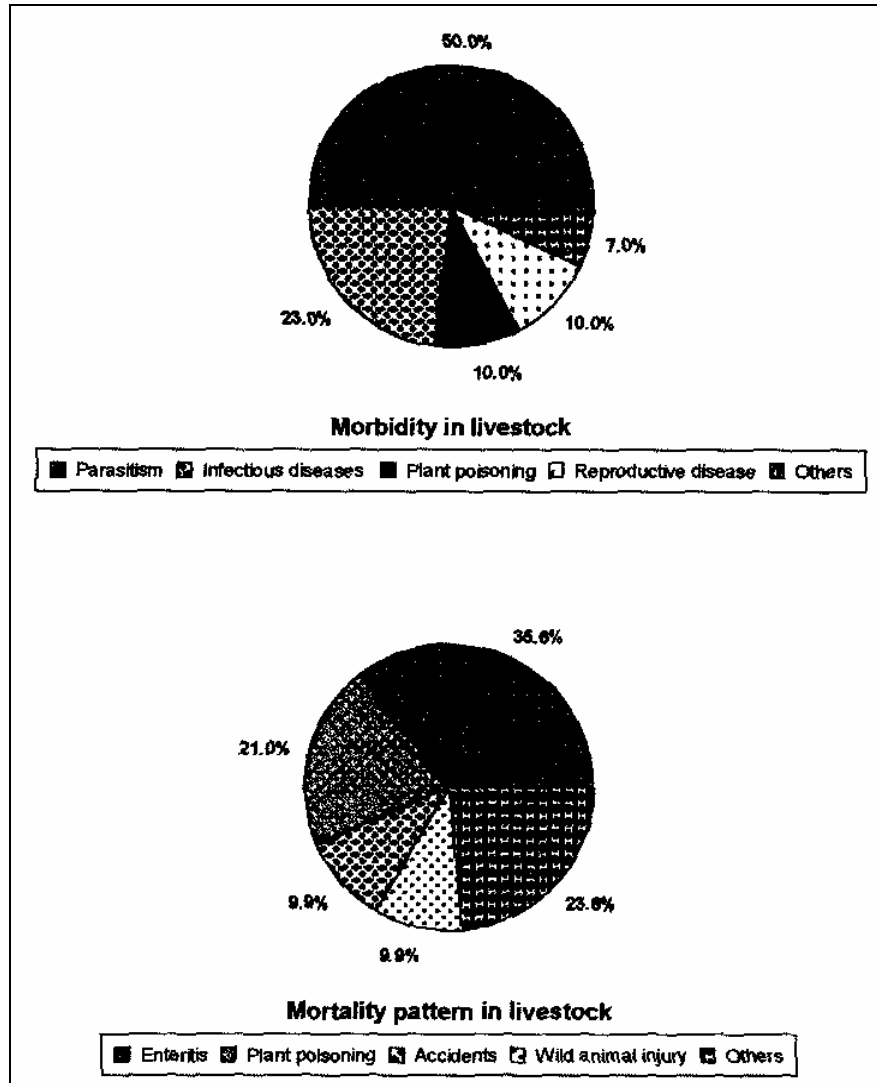


Figure 10. Morbidity and mortality pattern in livestock

**Priorities for research and development of sustainable parasite control**

GI parasitism is the single most important cause of production losses in small ruminants (Jithendran, 1998) as well as large ruminants (Chauhan, 1994). In the absence of an alternative to chemotherapy, the research activities aimed at minimising the use of anthelmintics and optimising their use to prevent the wide spread resistance. Recent research emphasised the role of improved nutrition in moderating the effects of concurrent parasitic infections. The use of non-protein nitrogen supplements in the form of urea molasses block (UMB) alone or medicated UMB with fenbendazole has resulted in even greater performance.

The use of nematophagus fungi and helminthic vaccines present control options that have considerable potential but are yet to be tested under local conditions. It must be stressed, however, that no single method is likely to reward if applied in isolation, but that a combination of methods is likely to be the most effective for a susceptible parasite control regime, suited to the needs of the individual farmers.

**Table 2. Important helminth parasites in cattle and buffaloes in Himachal Pradesh**

Parasite	(s) Geographical area	Location	Intermediate host	Pathology	Source/study	Reference (s)
<i>Fasciola gigantica</i>	Kangra, Kullu, Mandi, Chamba	Liver/bile duct	<i>Lymnaea auricularia</i>	Severe	Farm/N.E., F.E.	Krishna <i>et al.</i> , 1989; Jithendran and Krishna, 1990 HPKV Annual report, 1989-98, Agnihotri <i>et al.</i> , 1992
<i>F. hepatica</i>	Kangra	"	"	Severe	Farm/N.E., F.E	Jithendran, 1998
<i>Dicrocoelium dendriticum</i>	Kangra, Chamba	"	?	Moderate	Farm/N.E., F.F	Krishna <i>et al.</i> , 1989, Jithendran <i>et al.</i> , 1983
<i>Paramphistomum cervi</i>	"	Rumen	<i>Indoplanorbis</i>	Mild	Farm/N.E	HPKV Annual report, 1990-98, Jithendran and Krishna, 1990



<i>Cotylophoron cotylophorum</i>	"	"	"	Mild	Farm/N.E	HPKV Annual report, 1990-98
<i>Gigantocotyle explanatum</i>	Kangra, Chamba	Liver	"	Mild	Farm/N.E	HPKV Annual report, 1990-98
<i>Gastrothylax cruminiifer</i>	"	Rumen	"	"	"	HPKV Annual report, 1990-98
<i>Schistosoma indicum</i>	Kangra	Portal/mes. vein	<i>L. leuteola</i>	Mild	Farm/F.E.	Krishna, <i>et al.</i> , 1989, Jithendran and Bhat, 1999
<i>Schistosoma spindale</i>	Kangra	Portal/mes. vein	"	Mild	Farm/F.E	Krishna, <i>et al.</i> , 1989, Jithendran and Bhat, 1999
<b>Cestode/metacestodes</b>						
<i>Moniezia expansa</i>	Kangra, Kullu	Intestine	?	Mild	Farm/N.E., F.E	Jithendran and Bhat, 1999
<i>M. benedini</i>	"	"	"	"	"	IVRI Annual report, 1986-98
<i>Stelisia</i> spp.	"	"	"	"	"	HPKV Annual report, 1990-98
<i>Avitellina</i> spp.	Kangra	"	"	"	"	HPKV Annual report, 1990-98
Hydatid	Kangra, Chamba	Visceral organs	-	"	Farm/N.E	IVRI Annual report, 1990-98
<b>Nematodes</b>						
<i>Toxocara vitulorum</i>	"	Intestine	-	"	Farm/N.E., F.E	Krishna, <i>et al.</i> , 1989, Jithendran and Bhat, 1999
<i>Dictyocaulus viviparus</i>	"	Lung/bronchi	-	Mild	"	Krishna, <i>et al.</i> , 1989, Jithendran and Bhat, 1999
<i>Haemonchus contortus</i>	"	Abomasum	-	Severe	"	Jithendran and Bhat, 1999
<i>Mecistocirrus digitatus</i>	"	"	-	"	"	IVRI Annual report, 1997
<i>Strongyloides</i> spp.	"	Intestine	-	Mild	"	Jithendran and Bhat, 1999
<i>Trichostrongylus axei</i>	"	"	-	Mild	"	"
<i>T. colubriformis</i>	"	"	-	"	"	"
<i>Paracooperia</i> spp.	"	"	-	"	"	"
<i>Capillaria</i> spp.	"	Intestine	-	"	"	"
<i>Oesophagostomum</i> spp.	"	"	-	"	"	Jithendran and Bhat, 1999
<i>Trichuris</i> spp.	"	"	-	"	"	Jithendran and Bhat, 1999
<i>Sitaria digitata</i>	"	Peritoneum	-	"	"	IVRI Annual report, 1987
<i>Thelazia rhodesii</i>	"	Eye	?	Mild	Farm/C.E	Krishna, <i>et al.</i> , 1990

F.E. - faecal examination, N.E. - Necropsy examination, C.E.- Clinical examination

**Table 3. Important helminth parasites in sheep and goats in Himachal Pradesh**

Parasite (s)	Geographical area	Location	Intermediate host	Pathology	Source/study	Reference (s)
1	2	3	4	5	6	7
<b>Trematodes</b>						
<i>Fasciola gigantica</i>	Kangra, Kullu, Shimla, Mandi, Chamba	Liver/bite dut	<i>Lymnaea auricularia</i>	Severe	Abattoir/ N.E., F.E.	Mathur, 1986; Jithendran, 1994, 1996, 1998, Mittra <i>et al.</i> , 1998
<i>Dicrocoelium dendriticum</i>	"	Bile duct	?	Moderate	"	Jithendran, 1994, 1998; Somvanshi <i>et al.</i> , 1992
<i>Paramphistomum epiclitum</i>	Shimla, Solan, Kinnaur, Chamba, Kangra, Hamirpur, Una, Bilaspur and Mandi	Rumen	<i>Indoplanorbis</i>	"	"	Vaidya, 1976, Jithendran and Krishna, 1990, Tandon and Sharma, 1981
<i>Paramphistomum cervi</i>	Kangra, Chamba	"	"	"	"	IVRI Annual reports, 1986-98
<i>P. inchikawai</i>	Shimla	"	"	"	"	Tandon and Sharma, 1981
<i>Calicophoron calicophorum</i>	Shimla, Kullu, Kinnaur	"	"	"	"	Vaidya, 1976, Tandon and Sharma, 1981
<i>C. crassum</i>	Shimla	"	"	"	"	Tandon and Sharma, 1981
<i>C. cauliorchis</i>	Shimla, Kinnaur	"	"	"	"	Tandon and Sharma, 1981
<i>C. papillosum</i>	Kangra, Kullu	"	"	"	"	Tandon and Sharma, 1981
<i>Cotylophoron</i>	Shimla,	Rumen	"	"	"	Tandon and Sharma, 1981

<i>cotylophorum</i>	Hamirpur, Mandi					
<i>C. chauhani</i>	Shimla, Solan	Rumen	"	"	"	Tandon and Sharma, 1981
<i>C. indicum</i>	Shimla, Kullu	Rumen	"	"	"	Tandon and Sharma, 1981
<i>Cylonocotyle dawesi</i>	Shimla	Rumen	"	"	"	Tandon and Sharma, 1981
<i>C. scoliocoelium</i>	Shimla, Hamirpur	Rumen	"	"	"	Tandon and Sharma, 1981
<i>C. streptocoelium</i>	Shimla, Hamirpur	Rumen	"	"	"	Tandon and Sharma, 1981
<i>C. tamilensis</i>	Shimla	Rumen	"	"	"	Tandon and Sharma, 1981
<i>Gastrothylax cruminifer</i>	Shimla, Chamba, Kullu	Rumen	"	"	"	Tandon and Sharma, 1981
<i>Fischoederius elongatus</i>	Shimla, Chamba, Kangra, Hamirpur	Rumen	"	"	"	Tandon and Sharma, 1981
<i>Gyganocotyle explanatum</i>	Kangra, Chamba	Liver/bile duct	"	"		Jithendran, 1996
<i>Schistosoma indicum</i>	Kangra	Portal/Mes. vein	<i>L. leuteola</i>	"	Farm/F.E	Jithendran, 1994, 1998
<i>Schistosoma spindale</i>	Kangra	"	"	"	"	Jithendran, 1994, 1998

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1	2	3	4	5	6	7
<b>Cestode/ metacestodes</b>						
<i>Moniezia expansa</i>	Kangra, Kullu, Chamba	Intestine	?	Mild	Abattoir/N.E	HPKV Annual report, 1990-98 Jithendran, 1994, 1998
<i>M. benedini</i>	"	"	?	"	"	"
<i>Stelisia</i> spp.	"	"	?	"	"	HPKV Annual report, 1990-98
Hydatid	Kangra, Chamba	Visceral organs	-	"	"	Jithendran, 1996, IVRI Annual report, 1990-98
<i>Cysticercus tennicolis</i>	Kangra, Chamba	"	-	"	"	IVRI Annual report, 1987
<i>Coenurus</i> (Gid)	Kangra, Kullu	Brain	-	"	Abattoir/C.E	"
<b>Nematodes</b>						
<i>Dictyocaulus filaria</i>	Kangra, Chamba, Kullu, Sirmour, Hamirpur	Lung/bronc hi	-	Mild, severe	"	Dhar and Dash, 1982, Krishna <i>et al.</i> , 1989, 1998, Jithendran, 1984, Asrani, <i>et al.</i> , 1998, Mandial <i>et al.</i> , 1999
<i>Protostrongylus rufescense</i>	"	"	?	"	Farm/N.E, F.E.	Asrani, <i>et al.</i> , 1998, Kanwar <i>et al.</i> , 1998
<i>Muellerius capillaris</i>	"	"	?	"	"	"
<i>Varestrongylus spp.</i>	"	"	?	"	"	Dhar and Dash, 1982
<i>Haemonchus contortus</i>	"	Abomasum	-	Severe	"	Dhar and Dash, 1986, Singh <i>et al.</i> , 1992, Katoch <i>et al.</i> , 1998, Katoch <i>et al.</i> , 1999
<i>Strongyloides</i> spp.	"	Intestine	-	Mild	"	Jithendran, 1998, Mittra <i>et al.</i> , 1998
<i>Bunostomum trigonocephalum</i>	"	"	-	Moderate	"	Jithendran, 1994, 1998
<i>Trichostrongylus axei</i>	"	Abomasum	-	Mild	"	"
<i>T. colubriformis</i>	"	Abomasum , Intestine	-	"	"	Jithendran, 1994, 1998, Mittra <i>et al.</i> , 1998
<i>Ostertagia</i> spp.	"	Intestine	-	"	"	Singh <i>et al.</i> , 1992
<i>Skrjabinema ovis</i>	"	Intestine	-	"	"	IVRI Annual report, 1987
<i>Cooperia punctata</i>	"	Intestine	-	"	"	"
<i>Capillaria</i> spp.	"	Intestine	-	"	"	"
<i>Oesophagostomun</i> spp.	"	"	-	"	"	Katoch <i>et al.</i> , 1997, IVRI Annual report, 1997
<i>Chabertia</i> spp.	"	"	-	"	"	Jithendran, 1998
<i>Trichuris</i> spp.	"	"	-	"	"	"

F.E. - faecal examination, N.E. - necropsy examination, C.E. - clinical examination

**Table 4.** Helminth parasites incriminated in some of the disease outbreaks in Himachal Pradesh

Host	Parasite (s)	Locality in H.P.	Year	Reference (s)
Sheep	<i>Haemonchus contortus</i>	Siroli	1986	IVRI Annual reports, 1987
Sheep	Amphistomes (immature)	Siroli	1986	IVRI Annual reports, 1987
Cattle	Amphistomes (immature)	Hamirpur	1986	IVRI Annual reports, 1986
Cattle, buffalo	<i>Fasciola gigantica</i>	Agojar (Palampur)	1986	IVRI Annual reports, 1989
Sheep, goat	<i>Dictyocaulus filaria</i>	Hamirpur	1987	IVRI Annual reports, 1987, 1996-97
	<i>Protostrongylus rufescens</i>	Sirmour, Kinnaur, Kangra	1997	Asrani <i>et al.</i> , 1998, Mandial <i>et al.</i> , 1998
Cattle	<i>Mecistocirrus</i>	Palampur	1997	IVRI Annual reports, 1996-97
Pig	<i>Ascaris suum</i>	Holta (Palampur)	1987	IVRI Annual reports, 1990
Sheep, goat	<i>H. contortus</i>	Jeuri	1997	Katoch <i>et al.</i> , 1998
Sheep	<i>H. contortus</i>	Nagwain	1998	Katoch <i>et al.</i> , 1999
Sheep, goat	<i>H. contortus</i> , <i>Strongyloides</i> <i>Trichostrongylus</i> spp.	Kangra	1998	Mittra <i>et al.</i> , 1998
Poultry	<i>Ascaridia galli</i>	Different localities	1986-1998	IVRI Annual reports, 1986-98

**Table 5.** Parasites in dairy cattle and buffaloes in Palampur (Himachal Pradesh)

Parasites	No (%) infected*			
	1986-1990		1993-1997	
	Cattle (n=1552)	Buffalo (n=530)	Cattle (n=1407)	Buffalo (n=107)
<b>Flukes</b>				
<i>Fasciola</i> spp.	559 (36.0)	258 (48.7)	88 (6.3)	22 (20.6)
<i>Amphistome</i> spp.	257 (16.6)	81 (15.3)	212 (15.1)	12 (11.2)
<i>Dicrocoelium</i> spp.	177 (11.4)	99 (18.7)	29 (2.1)	2 (1.9)
<i>Schistosoma</i> spp.	9 (0.6)	2 (0.4)	0 (0.0)	0 (0.0)
<b>Cestodes</b>				

<i>Moniezia</i> spp.	45 (2.9)	15 (2.8)	12 (0.9)	2 (1.9)
Nematodes				
<i>Strongyle</i> spp.	487 (31.4)	155 (29.2)	190 (13.5)	17 (15.9)
<i>Strongyloides</i> spp.	142 (9.1)	22 (4.2)	24 (1.7)	6 (5.6)
<i>Toxocara</i> spp.	69 (3.9)	24 (4.5)	27 (2.1)	2 (1.9)
<i>Dictyocaulus</i> spp.	30 (1.9)	3 (0.6)	9 (0.7)	0 (0.0)
<i>Trichuris</i> spp.	81 (5.2)	12 (2.3)	21 (1.6)	0 (0.0)
<i>Capillaria</i> spp.	21 (1.4)	6 (1.1)	12 (0.9)	0 (0.0)

\*Total numbers and total percentage of animals exceed expected values owing to multiple parasitisms

**Table 6.** Prevalence of gastrointestinal parasites in sheep and goats Himachal Pradesh

Parasites	No (%) infected*		
	Sheep (n=335)	Goat (n=158)	Overall (n=493)
<b>Flukes</b>			
<i>Fasciola</i> spp.	32 (9.6)	14 (8.8)	46 (9.3)
<i>Amphistome</i> spp.	13 (3.8)	4 (2.5)	17 (3.4)
<i>Dicrocoelium</i> spp.	24 (7.2)	4 (2.5)	28 (5.7)
<i>Schistosoma</i> spp.	4 (1.2)	1 (0.6)	5 (1.0)
<b>Cestodes</b>			
<i>Moniezia</i> spp.	9 (2.7)	2 (1.3)	11 (2.2)
<b>Nematodes</b>			
<i>Strongyle</i> spp.	307 (91.6)	158 (100)	465 (94.3)
<i>Strongyloides</i> spp.	16 (4.8)	8 (5.1)	24 (4.9)
<i>Dictyocaulus</i> spp.	4 (1.2)	2 (1.3)	6 (1.2)
<i>Trichuris</i> spp.	48 (14.3)	2 (1.3)	75 (15.2)

\*Total numbers and total percentage of animals exceed expected values owing to multiple parasitism

## REFERENCE

- Agnihotri, R.K., Mitra, S., Katoch, R.C., Gupta, V.K. and Sambyal, D.S. 1992. A note on the prevalence of cattle gastrointestinal helminths in Kangra valley, Himachal Pradesh. *J. Hill Res.*, 5: 188-185.
- Anonymous, 1985. *Himachal Pradesh, brief facts*. Directorate of economics and statistics, Shimla, H.P.
- Anonymous, 1994. *Statistical outline, Himachal Pradesh*, Directorate of economics and statistics, Shimla, H.P.
- Anonymous, 1997. In: *Dairy India 1997*, 5th edn. Baba Barkha Nath printers and publishers, New Delhi.
- Asrani, R.K., Batta, M.K., Katoch, R.C., Jithendran, K.P., Gupta, V.K. and Singh, S.P. 1999. An outbreak of verminous bronchopulmonitis among sheep and goats in Himachal Pradesh. *Indian J. Anim. Sci.*, (in press).
- Berkes, F., Hunt, I.D. and Hunt, K.D. 1998. Diversity of common property resource use and diversity of social interests in the western Indian Himalaya. *Mountain Research and Development.*, 18: 19-33.
- Chakravarty, M.K. 1998. Transhumance and customary postoral rights in Himachal Pradesh: Claiming the high pastures for Gaddis. *Mountain Research and Development.*, 18: 5-17.
- Chauhan, S.K. 1995. Trend in milk production in Himachal Pradesh. *Indian J. Animal Sci.*, 65: 583-588.
- Chauhan, S.K., Sharma, R.K. and Gupta, Monika. 1994. Economic losses due to diseases and constraints for dairy development in Kangra district of Himachal Pradesh. *Indian J. Animal Sci.*, 64: 61-65.
- Dhar, D.N. and Dash, P.K. 1982. Lungworm and strongylate nematode infections in sheep in the Kullu valley, Himachal Pradesh. *Indian J. Parasitol.*, 6: 53-55.
- Duffield, C., Gardner, J.S., Berkes, F. and Singh, R.B. 1998. Local knowledge in the assessment of resource sustainability: Cases studies in Himachal Pradesh, India and British Columbia, Canada. *Mountain Research and Development.*, 18: 5-17.
- HPKV Annual reports. 1990-98. Himachal Pradesh Krishi Vishwa Vidyalaya, Palampur, Himachal Pradesh.
- IVRI Annual reports. 1986-98. Indian Veterinary Research Institute, Izatnagar, U.P.
- Jithendran, K.P. 1994. Gastrointestinal parasitism in gaddi sheep and goats in Kangra valley, Himachal Pradesh. *J. Hill Res.*, 7: 9-12.
- Jithendran, K.P. 1996. Occurrence of hydatidosis and various liver fluke infections in sheep and goats in

- Kangra valley: An abattoir study. *J. Vet Parasitol.*, 10: 63-67.
- Jithendran, K.P. 1998. Epidemiology of gastrointestinal parasites in migratory sheep and goats in north west humid Himalayan region. *Indian J. Anim. Sci.*, 68: 894-896.
- Jithendran, K.P. 1999. A note on occurrence of *Fasciola hepatica* in a calf. *Indian J. Vet. Research*, 8: 2.
- Jithendran, K.P. and Bhat, T.K. 1996. Prevalence of microcoeliosis in sheep and goats in Himachal Pradesh, India. *Vet. Parasitol.* 61: 265-271.
- Jithendran, K.P. and Bhat, T.K. 1999. Epidemiology of parasitoses in dairy animals in the north west humid Himalayan region of India with particular reference to gastrointestinal nematodes. *Trop. Anim. Hlth. Prod.*, 31: 205-214.
- Jithendran, K.P. and Krishna, L. 1990. Freshwater snails with larval trematodes in Kangra valley, Himachal Pradesh. *J. Vet. Parasitol.*, 4: 51-53.
- Jithendran, K.P. and Krishna, L. 1991. Liver fluke infection and its control. *Livestock Advisor*, 16: 24-26.
- Jithendran, K.P. and Rao, J.R. 1996. Parasitic zoonoses: Role of migratory sheep and goats in Himachal Pradesh. *Hima Paryavaran*. 8: 6-8.
- Jithendran, K.P., Krishna, L. and Vaid, J. 1993. A preliminary note on microcoeliosis in livestock. *Indian J. Vet. Pathol.*, 17: 52.
- Jithendran, K.P., Sharma, O.P., Dawra, R.K., Makkar, H.P.S. and Singh, B. 1998. Survey on animal husbandry practices, bottlenecks in animal production and strategies for improvement: a profile of selected villages in Himachal Pradesh. *ENVIS Bulletin*, 6: 6-13.
- Jithendran, K.P., Vaid, J. and Krishna, L. 1996. Comparative evaluation of Agar gel precipitation test, counterimmuno electrophoresis and passive haemagglutination test for the diagnosis of *Dicrocoelium dendriticum* infection in sheep and goats. *Vet. Parasitol.* 61: 151-156.
- Kanwar, N.S., Paliwal, O.P. and Kumar, R. 1998. Verminous pneumonia in goats. *J. Vet. Parasitol.*, 12: 139-140.
- Katoch, R., Kalia, O.P., Mittra, S. and Agnihotri, R.K. 1997. Breed susceptibility of goats to gastrointestinal nematodes. Paper presented at IXth National Congress of Veterinary Parasitology at PAU, Ludhiana, 6-8 October, 1997.
- Katoch, R., Mandial, R.K. and Nagal, K.B. 1999. Outbreak of *Haemonchus contortus* infection in sheep at high altitude of Himachal Pradesh. *Indian Vet. J.*, (in press).
- Katoch, R., Mittra, S., Agnihotri, R.K. and Sharma, A.K. 1998. Winter strongylosis in sheep and goats at high altitude: A sporadic occurrence. *Indian Vet. J.*, 75: 362-363.
- Krishna, L. Jithendran, K.P. and Agnihotri, R.K. 1989. A report on *Thelazia rhodesii* in buffalo in Himachal Pradesh. *Indian Vet. Med. J.*, 13: 139-140.
- Krishna, L., Jithendran, K.P. and Vaid, J. 1989. Incidence of common parasitic infections amongst ruminants in Kangra Valley of Himachal Pradesh. *Int. J. Anim. Sci.*, 4: 183-184.
- MAFF, 1984. *Manual of Veterinary Investigation*, Vol.2 (Reference Book, 390, HMSO, London), 161-187.
- Mandial, R.K., Agnihotri, R.K., Mittra, S., Katoch, R. and Prasad, B. 1999. A note on the outbreak of lung worm with mixed nematodiasis in goats of Kangra hill. *Indian Vet. J.*, (in press).
- Mathur, P.B. 1986. A note on fascioliasis in sheep in Himachal Pradesh. *Indian J. Vet. Med.*, 6: 120-121.
- Mittoo, H.K. 1993. *Himachal Pradesh*. National Book Trust (India). 126p.
- Mittra, S., Agnihotri, R.K. and Nagal, K.B. 1998. Sporadic deaths in migratory flocks of sheep due to strongyle nematodes. *Himachal Vet. J.*, 1: 32-34.
- Mittra, S., Patyal, V. and Agnihotri, R.K. 1998. Distomiasis in a flock of migratory goats. Abstract submitted in X NCVP, Jabalpur, 4-6 December, 1998. pp. 27.
- Rahman, S.A. 1985. *Helminth parasites of veterinary importance in India*. Inter Vet Publishers, 124/21, 7th B Main Road. 4th Block (west), Jayanagar, Bangalore. pp. 15.
- Sanyal, P.K. 1998. Integrated gastrointestinal parasite management in dairy animals in Gujarat by self medication. *J. Vet. Parasito.* 12: 17-20.
- Shan, H.L. and Chaudhry, R.K. 1995. Parasitism in dairy animals in India: Present status and its impact. In: Proceedings of the workshop on control strategy against gastrointestinal parasites in dairy animals in India using medicated urea molasses blocks. (NDDB, Anand, India) 1-5.
- Somvanshi, R. Vaid, J., Biswas, J.C. and Jithendran, K.P. 1992. Clinicopathological observations on

- dicrocoeliosis in goats. *Indian J. Vet. Pathol.* 16: 112-114.
- Soulsby, E.J.L. 1965. *Text book of Veterinary Clinical Parasitology*. Vol.1: Helminth (Blackwell Scientific, Oxford), 279-305.
- Soulsby, E.J.L. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*, 7th edn., (ELBS, Bailliere-Tindall, London), 760-778.
- Tandon, V. and Sharma, V. 1981. Amphistome fauna of ruminants in Himachal Pradesh. *Indian J. Parasitol.*, 5: 241-245.
- Vaidya, J. 1976. Studies on the paramphistome flukes parasitising some ruminant hosts in Shimla and its suburbs. M. Phill. thesis. H.P. University, Shimla.