Int J Biol Med Res.2019 ;10(1):6579-6586

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International Journal of Biological & Medical Research

Journal homepage: www.biomedscidirect.com


## Original article

# Gastrointestinal helminth parasites of cattle and buffalo in Kashmir valley, India: Overall, seasonal & monthly prevalence

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ARTICLE INFO

***Keywords:***
*Cattle*
*Buffalo*
*Helminth*
*Prevalence*
*Month*
*Season*

ABSTRACT

Abstract: During the present study for two years on the epidemiology of gastro-intestinal helminths in cattle and buffalo of Kashmir Valley, a total of 18 helminths species were recorded. Nematode and trematode species were dominant helminths followed by cestode species. The overall prevalence of trematodes was found 53.96% & 49.64% in cattle & buffalo. Data on monthly incidence of helminth infection showed that higher infection of helminths occurred in the month of June, July and August. Regarding the seasonal fluctuation of helminths, trematode infection was highest (63.26%) in autumn and summer (67.80%) and lowest in winter (47.51% & 26.92%) in cattle. While as in buffaloes, the highest infection was reported in summer (44.68% & 68.51%) and lowest in winter (21.73% & 52.94%). In case of cattle the cestode infection was maximum in summer (9.58%) & winter (13.04%). While as in case of buffaloes, the highest infection was found in summer (9.25%) and in autumn (9.52%). In both hosts, the lowest prevalence was found during winter (3.54% & 5.12%); autumn (4.16%) and in spring (8.00%) respectively. The highest gastrointestinal nematode infection in cattle was reported in summer (53.84%) of first year and again in summer (70.54%) of next year. The lowest infection in both the years in case of cattle was reported in winter (39.74% & 32.62%). In buffaloes, the highest nematode infection as per the gut examination was found in spring in both the years (60.00% & 54.05%) and the lowest infection was reported in winter (34.78% & 25.49%) respectively.

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## Introduction

Helminth parasitism, especially gastrointestinal parasitism, is one of the major health problems severely limiting the animal productivity (Maitra et al. 2014). Parasitic infections are the major constraints for profitable dairy industry in tropical and subtropical countries including India (Marskole et al. 2016). For sustained production, it is essential that the livestock remains healthy. In India, the problem of parasitic disease is more serious as cattle and buffaloes are the main source of milk and milk products for humans, and a source of livelihood for the former engaged in diary industry (Gupta et al., 2002). Therefore, the animals must be protected from various parasitic diseases. Parasitic infections are commonly encountered in domestic ruminants reared under traditional animal husbandry systems in India. These infections cause considerable economic losses in terms of productivity and lowering down the immune status of the animals, which become susceptible to secondary infections (Roy et al., 2004). All living beings can, in certain circumstances become subject to diseases and bovines and Bublines make no exception. Husbandry practice of up gradation of indigenous stocks affected the health of livestock and is responsible for the changing patterns of infectious and non-infectious diseases (Singh et al. 2002) livestock owners are now more conscious about health status of the animals and are well familiar with the concept of "prevention is better than cure." Therefore, in the changed perspective, it is important to have knowledge of epidemiology of disease.

The development of appropriate procedures for control and prevention of helminth parasite infection requires knowledge of the factors that promote development and transmission of parasite under varying pasture management and climatic conditions (Familton and McAnulty, 1995). Over 90% of the total parasite population exists outside the ruminant host as eggs or larvae in the faeces or in the soil (Familton and McAnulty, 1995, 1996, 1997; Vlassoff, 1998). The epidemiology of helminth diseases is determined by several factors governed by the environment-host-parasite interaction. Majority of the hosts had mixed helminth infections, which reflect upon animal production losses due to these parasites. The trichostrongylid nematode species of economic importance which have been most frequently identified from sub-tropical areas include Haemonchus,

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Nematodirus spp., Mecistocirrus spp. and Ostertagia spp. (Khan et al., 1988; Dorny et al., 1995; El-Azazy, 1995; Jacquiet et al., 1995; Suarz and Busetti, 1995; Maqsood et al., 1996; Ankers et al., 1997; El-Sayed, 1997).

For collecting epidemiological data, different studies are performed like survey, surveillance to identifying trends of morbidity, mortality, transitions from one normal or disease state to another and factors acting behind this and accurate diagnosis of disease outbreak. Diagnosis at the population level must be extensive, holistic as well as intensive, reductionistic way. Its special objective is early detection of cases and definition of population level disease problem. The above introduction clearly indicates that there is a tremendous scope to increase the production of live stock if parasitological aspects are taken care of. It is this backdrop that the present study contains investigations on the epidemiology of gastrointestinal helminth infections in bovines and bublines of Kashmir Valley.

## 2. Materials and methods

### 2.1. Study area and site

The study was conducted in ten districts of Kashmir, India which is located in between the inner Himalayan range to the east comprising of the Nanga Parbat and the outer Himalayan range to the west and south called the Pir Panjal. It is situated between 32o-37′ latitude and 73o-80′ longitude at an altitude of 5,000 ft. above sea level. This valley is bounded on the north by the Karakoram Range, on the northeast by Ladakh and on the south by Jammu. The highest mountain peaks enclosing the valley have an elevation of more than 5,300 meter above sea level on the Great Himalayan side and more than 5,500 meter above sea level on the Pir Panjal side. In Kashmir valley the temperature reaches to below -5oC in winter to above 30oC in summer. At higher altitudes, the snow remains on the peaks for most of the year. The maximum temperature during the summer ranges from 15oC in the mountains to 30oC in the valley Lakes. The driest months of the year are usually September to November and in June before the monsoons develop any strength. During the cold season, from December to April, much of the precipitation is accumulated as snow, particularly at higher altitudes.

### 2.2. Collection and processing of samples

The study was conducted from July 2014 to June 2016. During the study period, a total of 1064 fresh faecal samples (782 cattle & 282 buffaloes) were collected either directly from the rectum or from top of freshly defecated uncontaminated faeces. Cold chain was maintained while bringing the samples in the laboratory.

### 2.3. Qualitative and quantitative analysis of faecal samples

Faecal examination of each animal was separately conducted regularly for a period of 2 years. Primary screening was done by preparing direct smears from the faecal samples to search eggs or larvae of helminth parasite. The samples were further examined by both floatation and sedimentation techniques for qualitative analysis. Stoll's egg counting technique (Sadar et al. 2006) with some modifications was used for egg counting or quantitative analysis. The eggs per gram (EPG) of a fecal sample was calculated by the following formula:

$$EPG = \frac{\text{Total number of eggs counted in 0.15 mL} \times \text{Dilution factor}}{\text{Volume of sample taken (0.15 mL)}}$$

### 2.4. Collection of samples from slaughter houses

Fresh helminths were also collected from local slaughter houses; stained helminths, whole mounts were prepared. These slides were examined and the genuses were identified with the help of key furnished by Dutt, 1980.

### 2.5. Statistical analysis

The mean prevalence of each parasite and its percentage was calculated by using appropriate formula and data were analyzed by analysis of variance (ANOVA). The whole data was fed into a Microsoft Excel 2010. A computer program (SPSS 11.5 for windows) and Primer software was used for data analysis. The prevalence was calculated by dividing the number of animals harboring a given parasite by the total number of animals examined for a particular parameter. The differences were considered to be significant when the p-value obtained was less than 0.05.

### 2.6. Ethical approval

Ethical approval was obtained from a committee of Research, Publication and Ethics of the Department of Zoology University of Kashmir, Srinagar- India. All procedures were explained to cattle & buffalo owners and owner's approvals were obtained.

## 3. Results

### 3.1. Overall prevalence of helminth parasites

An analysis of the data on the prevalence of helminths in cattle and buffalo of Kashmir Valley indicated that a total of 18 speceis of helminths were recorded. Trematodes and nematodes were predominantly occurring (n=8) helminths followed by Cestodes (n=2) (Table 1).

**Table 1. Distribution and percent prevalence of helminth species in cattle and buffalo hosts in Kashmir valley**

| Species of helminth | Prevalence of helminths | |
|---|---|---|
| | Cattle | Buffalo |
| | % Prevalence of helminth species | % Prevalence of helminth species |
| *Haemonchus* | 35.166 (275/782) | 34.39 (97/282) |
| *Ostertagia* | 26.72 (209/782) | 26.95 (76/282) |
| *Chabertia* | 26.43 (206/782) | 22.69 (64/282) |
| *Oesophagostomum* | 20.46 (160/782) | 16.66 (46/282) |
| *Trichuris* | 18.79 (147/782) | 11.34 (32/282) |
| *Nematodirus* | 17.39 (136/782) | 7.44 (21/282) |
| *Mecistocirrus* | 14.57 (114/782) | 3.19 (9/282) |
| *Setaria* | 9.59 (75/782) | 2.83 (8/282) |
| *Fasciola hepatica* | 1.27 (10/782) | 1.77 (5/282) |
| *Fasciola gegantica* | 9.33 (73/782) | 11.34 (32/282) |
| *Dicrocoelium* | 3.06 (24/782) | 4.60 (13/282) |
| *Paramphistome* | 13.55 (106/782) | 14.53 (41/282) |
| *Moniezia* | 6.52 (51/782) | 7.80 (22/282) |

(Figures in parenthesis are the number of hosts found positive/total number of animals examined)

Helminths having direct life cycles were the most common parasites in the study area. Trichostrongylus and Haemonchus were of the highest concern as they infected majority of the large ruminants with a prevalence range of 14.57% to 35.60% in the study area. Majority of the combined infections were those of nematodes. Prevalence of trematodes was found in 53.96% in cattle and 49.64% in buffalo. Amongst trematodes, prevalence of Paramphistome (14.53%) in buffalo and 13.55% in cattle was observed and were highest followed by Fasciola spp. 13.12% in buffalo and 10.16% in cattle and the lowest prevalence of Dicrocoelium spp. 4.60% in buffalo and 3.06% in cattle. Among cestodes the only genus reported was Moniezia with a percentage prevalence of 7.80% in buffalo and 6.52% in cattle.

### 3.2. Monthly prevalence of helminth parasites

Trematode infections in cattle were highest in June 2015 (80.00%) and again in the same month June 2016 (86.66%) (Tables 2 & 3). The data was statistically significant p=0.001 and 0.000 ($p<0.05$). While as in buffalo the highest infection was in the month of September 2014 (83.33%) and of June 2016 (55.55%). The lowest infection as per the gut examination in cattle and buffalo were in January 2015 (25.00%); in February 2016 (2.66%); in January 2015 (16.66%) and in January 2016 (33.33%). Again the data was found statistically significant i.e; p= 0.001 & 0.000 ($p<0.05$). Cestode infection in cattle which were observed highest in July 2014 (12.50%) i.e; p=0.000 ($p<0.05$) and in August 2015 (13.79%) p= 0.000 ($p<0.05$) and were zero i.e. 0% in February 2015 and in March 2016 (Tables 2 & 3). In buffalo the highest cestode infection as per the gut examination were found in the months of July 2016 (50.00%), p= 0.002 ($p<0.05$); August 2015 (50.00%) and July 2015 (11.11%). The lowest infections were reported in the months of February 2015; April 2015 and January 2016 (i.e. 0%) P=0.000 ($p<0.05$).

**Table 2. Month wise distribution of helminthiasis in bovines and bublines from July 2014 to June2015 (NE=number of hosts examined; NP= number of hosts found positive for infection)**

| Month | Host | NE | Infected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Nematode | | Trematode | | Cestode | | P-value |
| | | | NP | % age | NP | %age | NP | %age | |
| July-14 | Cattle | 8 | 3 | 37.50 | 5 | 62.50 | 1 | 12.50 | 0.000 |
| | Buffalo | 2 | 1 | 50.00 | 1 | 50.00 | 1 | 50.00 | 0.002 |
| Aug.- 14 | Cattle | 10 | 6 | 60.00 | 7 | 70.00 | 1 | 10.00 | 0.001 |
| | Buffalo | 2 | 1 | 50.00 | 1 | 50.00 | 1 | 50.00 | 0.02 |
| Sep.- 14 | Cattle | 38 | 19 | 50.00 | 20 | 52.63 | 4 | 10.52 | 0.002 |
| | Buffalo | 18 | 9 | 50.66 | 10 | 55.55 | 2 | 11.11 | 0.009 |
| Oct.- 14 | Cattle | 30 | 17 | 56.66 | 21 | 70.00 | 2 | 6.66 | 0.007 |
| | Buffalo | 12 | 6 | 50.00 | 4 | 33.33 | 1 | 8.33 | 0.02 |
| Nov.- 14 | Cattle | 28 | 19 | 67.85 | 9 | 32.14 | 1 | 3.57 | 0.006 |
| | Buffalo | 8 | 4 | 50.00 | 2 | 25.00 | 1 | 12.50 | 0.004 |
| Dec.-06 | Cattle | 20 | 5 | 25.00 | 6 | 30.00 | 2 | 10.00 | 0.02 |
| | Buffalo | 4 | 1 | 25.00 | 1 | 25.00 | 1 | 25.00 | 0.01 |
| Jan.- 14 | Cattle | 18 | 4 | 22.22 | 3 | 25-00 | 1 | 5.55 | 0.009 |
| | Buffalo | 5 | 1 | 20.00 | 1 | 16.66 | 1 | 20.00 | 0.002 |
| Feb.-15 | Cattle | 12 | 3 | 25.00 | 3 | 25.00 | 0 | 0 | 0.04 |
| | Buffalo | 6 | 2 | 33.33 | 1 | 16.66 | 0 | 0 | 0.004 |
| Mar.- 15 | Cattle | 28 | 7 | 25.00 | 14 | 50.00 | 1 | 3.57 | 0.006 |
| | Buffalo | 7 | 3 | 42.85 | 2 | 28.57 | 1 | 14.28 | 0.01 |
| April-15 | Cattle | 24 | 7 | 29.16 | 18 | 75.00 | 1 | 4.16 | 0.03 |
| | Buffalo | 5 | 3 | 60.00 | 2 | 40.00 | 0 | 0 | 0.005 |
| May-15 | Cattle | 60 | 49 | 81.6 | 19 | 31.66 | 3 | 5.00 | 0.04 |
| | Buffalo | 25 | 17 | 68.00 | 7 | 28.00 | 1 | 4.00 | 0.006 |
| June-15 | Cattle | 50 | 20 | 40.00 | 40 | 80.00 | 5 | 10.00 | 0.009 |
| | Buffalo | 22 | 12 | 54.54 | 11 | 50.00 | 1 | 4.54 | 0.02 |
| Total | **Cattle** | **326** | **159** | **48.77** | **165** | **50.61** | **22** | **6.74** | |
| | **Buffalo** | **116** | **60** | **51.72** | **43** | **37.06** | **11** | **9.48** | |

From Tables 2 & 3 it is shown that highest gastrointestinal nematode infection in cattle was reported in the month of May 2015 and August 2015 (81.6% & 86.60%) and lowest in January 2015 and 2016 (22.22% & 5.00%) (p= 0.000 & p=0.000). The highest gastrointestinal nematode infection in buffalo were reported in months of May 2015 and April 2016 (68.00% & 57.14%) and lowest in January 2015 and May 2016 (20.00% & 5.58%) (p= 0.000 & p=0.000).

**Table 3. Month wise distribution of helminthiasis in bovines and bublines, from July 2007 to June2008 (NE=number of hosts examined; NP= number of hosts found positive for infection)**

| Month | Host | NE | Infected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Nematode | | Trematode | | Cestode | | P- value |
| | | | NP | % age | NP | %age | NP | %age | |
| July-15 | Cattle | 25 | 21 | 84.00 | 14 | 56.00 | 2 | 8.00 | 0.007 |
| | Buffalo | 9 | 5 | 55.55 | 6 | 66.66 | 1 | 11.11 | 0.03 |
| Aug-15 | Cattle | 29 | 25 | 86.60 | 15 | 51.72 | 4 | 13.79 | 0.02 |
| | Buffalo | 10 | 4 | 40.00 | 6 | 60.00 | 1 | 10.00 | 0.01 |
| Sep-15 | Cattle | 44 | 35 | 79.54 | 25 | 56.81 | 6 | 13.63 | 0.005 |
| | Buffalo | 16 | 7 | 43.75 | 10 | 62.50 | 1 | 6.25 | 0.009 |
| Oct-15 | Cattle | 42 | 24 | 57.14 | 28 | 66.66 | 3 | 7.14 | 0.04 |
| | Buffalo | 16 | 6 | 37.5 | 8 | 50.00 | 1 | 6.25 | 0.001 |
| Nov-15 | Cattle | 42 | 27 | 64.28 | 28 | 66.66 | 1 | 2.38 | 0.009 |
| | Buffalo | 15 | 7 | 46.66 | 8 | 53.33 | 1 | 6.66 | 0.004 |
| Dec-15 | Cattle | 36 | 7 | 19.44 | 12 | 33.33 | 2 | 5.55 | 0.008 |
| | Buffalo | 13 | 3 | 23.07 | 6 | 46.15 | 1 | 7.69 | 0.03 |
| Jan-16 | Cattle | 33 | 5 | 15.00 | 19 | 57.57 | 1 | 3.03 | 0.007 |
| | Buffalo | 12 | 1 | 8.33 | 4 | 33.33 | 0 | 0 | 0.009 |
| Feb-16 | Cattle | 30 | 7 | 23.33 | 8 | 26.66 | 1 | 3.33 | 0.008 |
| | Buffalo | 11 | 2 | 18.18 | 9 | 81.81 | 1 | 9.09 | 0.004 |
| Mar-16 | Cattle | 40 | 16 | 40.00 | 11 | 27.50 | 0 | 0 | 0.03 |
| | Buffalo | 14 | 6 | 42.85 | 5 | 35.71 | 1 | 7.14 | 0.01 |
| April-16 | Cattle | 39 | 23 | 58.97 | 21 | 53.84 | 2 | 5.12 | 0.009 |
| | Buffalo | 14 | 8 | 57.14 | 9 | 64.28 | 1 | 7.14 | 0.006 |
| May-16 | Cattle | 51 | 35 | 68.62 | 37 | 72.57 | 3 | 5.88 | 0.02 |
| | Buffalo | 18 | 12 | 5.58 | 11 | 61.11 | 1 | 5.55 | 0.008 |
| Jun-16 | Cattle | 45 | 22 | 48.88 | 39 | 86.66 | 4 | 8.88 | 0.002 |
| | Buffalo | 18 | 7 | 38.88 | 15 | 83.33 | 1 | 5.55 | 0.001 |
| **Total** | **Cattle** | **456** | **247** | **54.16** | **257** | **56.35** | **29** | **6.35** | |
| | **Buffalo** | **166** | **68** | **40.96** | **97** | **58.43** | **11** | **6.62** | |

### 3.3. Seasonal prevalence of helminth parasites

Trematode infection in cattle was highest (63.26%) in autumn in the year from July 2014 to June 2015 and summer (67.80%) in July 2015 to June 2016 and lowest in winter (47.51% & 26.92%) in both the years and the data were found statistically significant p=0.017 & p=0.016 which is less than 0.05 (Tables 4 & 5). While as in Buffalo the highest infections were reported in summer seasons in both the years (44.68% & 68.51%) and lowest in winter season in both the years (21.73% & 52.94%) p= 0.007 & p=0.008 ($p<0.05$).

Tables 4 and 5 shows that there exist highly significant differences (p=0.010 & p=0.014) among four seasons in both the host species with maximum incidence in summer season (9.58%) and winter season (13.04%) in both the years in cattle. While as in case of buffalo, the highest infection was found in summer (9.25%) and in autumn (9.52%). In both bovines and bublines the lowest prevalence were found during winter season (3.54% & 5.12%) in both the year and autumn (4.16%) and in spring (8.00%) and again the data were found statistically significant i.e; p=0.008 & p=0.019.

**Table 4. Seasonal distribution of helmintiasis of bovines and bublines, from July 2014 to June 2015 (NE=number of hosts examined; NP= number of hosts found positive for infection)**

| Season | Host | NE | Infected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Nematodes | | Trematodes | | Cestodes | | P-value |
| | | | NP | % age | NP | %age | NP | %age | |
| **Spring** | Cattle | 82 | 39 | 47.56 | 42 | 51.21 | 5 | 6.09 | **0.008** |
| | Buffalo | 25 | 15 | 60.00 | 8 | 32 | 2 | 8.00 | |
| **Summer** | Cattle | 117 | 63 | 53.84 | 71 | 60.68 | 9 | 7.69 | **0.0.016** |
| | Buffalo | 47 | 27 | 57.44 | 21 | 44.68 | 4 | 8.51 | |
| **Autumn** | Cattle | 49 | 26 | 53.06 | 31 | 63.26 | 4 | 8.16 | **0.014** |
| | Buffalo | 21 | 10 | 47.61 | 9 | 42.85 | 2 | 9.52 | |
| **Winter** | Cattle | 78 | 31 | 39.74 | 21 | 26.92 | 4 | 5.12 | **0.0008** |
| | Buffalo | 23 | 8 | 34.78 | 5 | 21.73 | 3 | 13.04 | |
| **Total** | **Cattle** | **326** | **149** | **48.77** | **165** | **50.61** | **22** | **6.74** | |
| | **Buffalo** | **116** | **60** | **51.72** | **43** | **37.06** | **11** | **9.48** | |

It is clear that highest gastrointestinal nematode infection in cattle was reported in summer (53.84%) from the year July 2014 to June 2015 and in summer (70.54%) of the year July 2015 to June 2016 (Tables 4 & 5). The lowest infection in both the years in case of bovines were reported in winter season (39.74% & 32.62%) (p=0.042 & 0.008) respectively. In bublines, the highest nematode infection as per the gut examination was found in the seasons of spring in both the years i.e., 60.00% in July 2014 to June 2016 & 54.05% in the year July 2015 to June 2016 and in both the years the lowest infection were reported in winter season i.e., 34.78% and 25.49% (p=0.019 & p=0.009) respectively.

**Table 5. Seasonal distribution of helmintiasis of bovines and bublines, from July 2015 to June 2016 (NE=number of hosts examined; NP= number of hosts found positive for infection)**

| Season | Host | NE | Infected | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Nematodes | | Trematodes | | Cestodes | | P-value |
| | | | NP | % age | NP | %age | N. P | %age | |
| Spring | Cattle | 105 | 57 | 54.28 | 51 | 48.57 | 4 | 3.80 | **0.042** |
| | Buffalo | 37 | 20 | 54.05 | 20 | 54.05 | 2 | 5.40 | |
| Summer | Cattle | 146 | 103 | 70.54 | 99 | 67.80 | 14 | 9.58 | **0.017** |
| | Buffalo | 54 | 26 | 48.14 | 37 | 68.51 | 5 | 9.25 | |
| Autumn | Cattle | 64 | 41 | 64.06 | 40 | 62.50 | 6 | 9.37 | **0.010** |
| | Buffalo | 24 | 9 | 37.50 | 13 | 54.16 | 1 | 4.16 | |
| Winter | Cattle | 141 | 46 | 32.62 | 67 | 47.51 | 5 | 3.54 | **0.019** |
| | Buffalo | 51 | 13 | 25.49 | 27 | 52.94 | 3 | 5.88 | |
| Total | Cattle | 456 | 247 | 54.16 | 257 | 56.35 | 29 | 6.35 | |
| | Buffalo | 166 | 68 | 40.96 | 97 | 58.43 | 11 | 6.62 | |

## 4. Discussion

In the present study, the overall results obtained from different slaughter houses of Kashmir Valley, a total of 1064 animals (282 buffaloes and 782 cattle) were examined. Of these 41 (14.53%) buffaloes and 24 (13.55%) cattle were found positive for Paramphistomosis. The prevalence rate of infection was comparable to the 20% of infected buffalo and cattle found by Haridy et al. 2006. They reported 7.3% infection in cattle and 10% in buffalo in Egypt; 16.6% in cattle and 15.3% in buffalo from India (Jithendran 2000); 25.20% in buffalo and 23.8% in cattle by Juyal et al. 2003 and 5.94% in cattle by Shanila and Hafeez, 2005 from India, 13.6% in cattle in Turkey by Sevimli et al. 2005, 17.1% by Phiri et al. 2006 from Zambian, 28% in cattle from Thialand by Morakot and Sakchi, 2006, where as 36% prevalence was observed in cattle from oceanic climatic areas of Lugo (NW Spain) by Diaz et al. 2007. 50% highest and 18.2% lowest prevalence was reported in cattle of Chiyasa and Kaleya from the Kafue wetlands of Zambia (Phiri et al. 2007). The prevalence of amphistomes is comparable to the findings of Raza et al. 2009, who reported prevalence of 17.64% in cattle of district Muzaffar Garh in Pakistan. However, Yadav et al. 2005 reported a prevalence of 26.56% in Jammu region. Predominance of paramphistomes over Fasciola spp. has been observed in the present study. Agrawal et al. 2004 and Yadav et al. 2005 have also reported predominance of amphistomes over Fasciola spp. in Madhya Pradesh and Jammu respectively. However, predominance of Fasciola spp. over Paramphistomes has been reported by Alam et al. 1994 and Raina et al. 1999 in Jammu region and Pandit et al. 2004 in Kashmir valley. Prevalence of Fasciola spp. was 13.12% (37/282) in buffalo and 10.61% (83/782) in cattle followed by Dicrocoelium spp. as lowest prevalence 4.60% (13/282) in buffalo and 3.06% (24/782) in cattle. The observed prevalence of Fasciola spp. was comparable to the findings of Akram and Najma, 2001 who reported prevalence of 10.50% in cattle and buffalo of district Charsaddah of NWFP in Pakistan. The results differed from Agrawal et al. 2004 who reported prevalence of 50.9% in Madhya Pradesh. Lowest prevalence of Dicrocoelium spp. (0.5%) was also reported by Akram and Najma, 2001 in district Charsaddah of NWFP in Pakistan. Among cestodes the only genus reported was Moniezia spp. with a prevalence of 6.52 % (51/782) in cattle and 7.80% (22/282) in buffalo. The result are comparable with the findings of Pandit et al. 2004 and Singh et al. 2008 who reported prevalence of 3.68 and 4.20% in cattle of Kashmir valley and district Faizabad of Uttar Pradesh respectively. However, findings are different from that of Akram and Najma, 2001 who reported 0.5% prevalence rate. The most prevalent nematode recovered in this study was Haemonchus. This was inconsonance with findings of Bali and Singh, 1977, Grant, 1981, Ahmed and Ansari, 1987, and Gupta et al. 1987. They also observed that Haemonchus was the most prevalent nematode species in small ruminants of their respective study areas. The higher prevalence could be due to the fact that this nematode has a relatively short generation interval and ability to take the advantage of favorable environmental conditions (Grant 1981). The mean monthly maximum temperature of 18°C or above and total monthly rainfall of 50 mm are conducive for translation and transmission of Haemonchus (Gordon, 1953). Therefore, climate of the study area for a larger part of the year is conducive for the propagation of Haemonchus larvae. A warm and moist summer is well suited to the development and survival of the free-living stages of nematodes (Grant 1981).

Prevalence of some species of helminths like Haemonchus and Trichostrongylus spp. decreased during some months of the year. This decrease was due to low temperature and rainfall in some months and low resistance of the free-living stages of this parasite to quick varying weather conditions (Kates, 1950), which were not conducive for the propagation of infective larvae. The pre-patent period for Haemonchus in sheep is on an average of 15 days (Soulsby, 1982). The larval development of Haemonchus contortus occurs optimally at relatively high temperatures, high humidity, microclimate of faeces and herbage, and high rainfall (Urquhart et al. 1985). Generally, temperature favorable for the development and translation of the free-living stages of Haemonchus may have a diurnal fluctuation between 23.3°C and 11.6°C (Dinnik and Dinnik, 1961) and mean monthly rainfall exceeding 50 mm (Grant, 1981).

Therefore, all these factors were favorable for the larval development of Haemonchus in Kashmir Valley. Trichostrongylus species (probably the 2nd most important parasite recorded in this study) are generally considered as cool-season parasites (Southcott et al. 1976), thrive best at mean monthly temperatures ranging from 2.8°C to 18.3°C and disappear when temperature exceeds 20°C (Gordon, 1953). The eggs and infective larvae of Trichostrongylus species have been reported to have a high capacity of survival under adverse weather conditions like cold or desiccation (Urquhart et al. 1985). Another important factor, which may influence the prevalence of helminths, is the peri-parturient stress, having important epidemiological significance (Connan, 1972; Lyons et al., 1987, 1992; Yazwinski and Featherstone, 1979; Gibbs and Barger, 1986). Stress due to parturition, lactation, weather and poor nutritional status of the animals is also a contributory factor for peri-parturient rise in egg/worm counts (Morgan et al. 1951; Crofton, 1963). High faecal egg counts result in pasture contamination; therefore, they have direct influence on the population dynamics of nematodes like that of Trichostrongylus (Barnes and Dobson, 1990). This is particularly true for the nematodes, which are highly prolific like Haemonchus laying up to 10000 eggs per day for several months and under optimum climatic conditions, gross contamination of the pasture can occur in a very short time (Radostitis et al. 1994).

The data clearly indicates the existence of helminth infections throughout the year. When the data on monthly incidence of helminth infection in two groups of buffalo and cattle were analyzed, it was observed that higher incidence of infection of Trematodes, cestodes and nematodes, occurred in cattle and buffalo in the months of June, July and August in both the hosts respectively. In Kashmir Valley, rains start in June, July and August every year. During this period there is abundance of snails on pastures. Animals during grazing ingest them and become affected with the disease. Nearly similar results were recorded by Gupta and Sing, 1990, Chaudhri et al. (1993), Dutta et al. (1995), Georgi et al. (1999), Maqbool et al. (2002), Khan et al. (2006) and Diaz et al. (2007). The lowest infection rates of nematodiasis, trematodiasis and cestodiasis in both the hosts were observed in the months of January and Febuary. Khan et al. (2006) also supported the observed results by reporting that the two most important factors influencing the incidence of helminthasis were adequate temperature and moisture in the environment, which helped the hatching of ova, the viability of encysting cercaria and population of snails. It was also noticed that cattle showing low prevalence of nematodes and trematodes than buffalo. Similar observations have been made by Maitra et al. (2014), Islam et al. (2014), Marskole et al. (2016), Alam et al. (2016).

The pattern of seasonal availability of infection of the rumen fluke is largely determined by temperature (Charleston 1997; Southey and Hosking 1998). The risk of exposure of grazing animals to infection was greatly influenced by the proportion of the grazing area that was snail habitat (Charleston 1997). Regarding the seasonal fluctuation of the revealed helminth parasites infecting slaughtered large ruminants, trematode incidence in this investigation was the highest in autumn and summer while the lowest was in winter. These results were consistent with that described by Rangel-Ruiz et al. 2003, Lee and Lee 1971; El-Shazley et al. 2002. Also, these results were in agreement with the results obtained by Mage et al. 2002 and Baldock and Arthur 1985. The higher incidence of trematodiasis during summer season is also supported by Misra et al. (1977). The achieved results were in contrast with Khallaayoune and El-Hari, 1991, Pfukenyi and Mukaratirwa, 2004; Phiri et al, 2005, Roy and Tandon (1992). While as Rolfe et al. (1991), Kunitskii (2000), Yadav et al. (2005) and Haridy et al. (2006), reported that the incidence of infected snails were highest during the rainy season. The higher prevalence rate of trematodiasis during summer season is logistic since during the drier months snail population becomes concentrated around areas of natural water which also have the most palatable grazing, thus there is concentration of snails, metacercariae and animals over a small area leading to heavy infection. Moreover, Moniezia spp, incidence increased in summer in both the cases and lowest prevalence was found in winter. The recorded prevalence of Moniezia spp. investigated in different abattoirs weas around the results concluded by Lee and Lee, (1971) while it was much higher than that detected by Regassa et al. (2006) and Aydenzoz and Yldz. (2002). These obtained results were not in accordance with Belem et al. (2001), who stated that Moniezia spp. infection was highest in rainy seasons. This difference may be attributed to the development, survival and transmission of eggs and infective larvae that in turn are influenced by climatic and environmental factors such as temperature, humidity and precipitation. The effects of these factors often result in seasonal fluctuation of the availability of infective larvae and subsequently in the prevalence of infections and worm burdens of the hosts.

Prevalence of nemathelminths was found higher in summer followed by spring, in both bovines and bublines. The lower infection was observed in winter in both the cases. Similar observations have also been reported from different states of India viz. D'Souza et al. (1988), Samanta and Santra (2007), Kaur and Kaur (2008) and Pandit et al. (2004) in cattle of Kashmir valley.

In conclusion, a large range of helminths was found in cattle and buffalo in Kashmir. A more accurate estimation of the genera/species involved and of the fluctuations of prevalence/intensity of infection is needed to evaluate their impact on the livestock productivity before proposing systematic drenching. It is actually crucial for rural poor smallholder farmers facing so many constraints (knowledge, investment, extension service among others) to prioritize the most relevant health or nutritional levers.

**Conflict of Interest**

We declare that we have no conflict of interest.

**Acknowledgment**

The authors are highly thankful to Head, Department of Zoology, University of Kashmir for providing the facilities required for conducting research work.

## REFERENCES


1. Agrawal MC, Vohra S, Gupta S, Singh KP. Prevalence of helminthic infections in domestic animals in Madhya Pradesh. Journal of Veterinary Parasitology 2004; 18(2):147-149.

2. Ahmed M, Ansari JA. Prevalence of gastrointestinal nematodes of sheep and goats in Aligarh (India). Indian Vet. Med. J., 1987; 11:165-170.

3. Akram S, Najma R. Coprological examination of domestic livestock for intestinal parasites in village Bahlola, District Charsaddah (Pakistan). Pakistan Journal of Zoology, 200; 133: 344-346.

4. Alam M, Rahman A, Sen MM, Sardar SA. Subclinical gastrointestinal parasitic infection in buffaloes and its effect on haemoglobin. Livestock Advisor, 1994; 19:29-31.

5. Ankers PSF, Biaye AE. Epidemiology of helminths of cattle, sheep and goats in Maritime Guinea, Guinea. Revue-d' Elevage-et-de-Medecine-Veterinairedes-Pays-Tropicaux, 1997; 50(2):111-116.

6. Aydenzoz M, Yldz K. Prevalence of Anoplocehalidae species in sheep and cattle slaughtered in Kirikkale, Turkey. Revue de Med Vet. 2002; 154(12): 767-71.

7. Baldock FC, Arthur RJ. A survey of fasciolosis in beef cattle killed at abattoirs in southern Queensland. Aust. Vet. J., 1985; 62: 324-326.

8. Bali MK, Singh RP. Studies on the prevalence of Haemonchus contortus in sheep and goats in Hissar. Haryana Agri. Univ. J. Res., 1977; 8: 143-148.

9. Barnes EH, Dobson RJ. Population dynamics of Trichostrongylus colubriformis in sheep: computer model to simulate grazing systems and theevolution of anthelmintic resistance. Inter. J. for Parasitol., 1990; 20:823-831.

10. Belem AMG, Ouédraogo OP, Bessin R. Gastro-intestinal nematodes and cestodes of cattle in Burkina Faso Biotechnol. Agron. Soc. Environ. 2001; 5(1):17-21.

11. Charleston WAG. Trematode parasites of ruminants in New- Zealand. In Sustainable Control of internal parasites in runinants: Animal indusrries work shop (edited by Barrel, G.K.). Canterbury, New Zealand; lincaln University, 1997; 237-262.

12. Chaudhri SS, Gupta RP, Kumar S, Singh J, Sangwan AK. Epidemiology and controle of Fasciola gigantica infection of cattle and buffaloes in eastern Haryana, India. Indian Journal of Animal Sciences, 1993; 63(6): 600-605.

13. Connan RM. The effect of host lactation on a second infection of conservation value of forest fragments. International Journal of Primatology, 1972. 28:513-528.

14. Crofton HD. Nematode Parasite Populations in Sheep and on Pasture. Technical Communication of Commonwealth Bureau of Helminthology, No. 35. St Albans, England, 1963; 104 p.

15. D'Souza PE, Jagannath MS, AbdualRahman S, Prevalence of gastro-intestinal parasitism in cows and buffaloes. Indian Journal of Animal Science, 1988; 58: 748-752.

16. Diaz P, Pedreira J, Arias M, Sanchez-Andrade R, Suarez JL, Arias MS, Francisco I, Fernandez G, Diez-Banos P, Morrondo P, Paz-Silva A. Risk periods of infection by Calicophorondaubneyi (Digenea: Paramphistomidae) in cattle from oceanic climate areas. Parasitol Res., 2007; 101(2):339-342.

17. Dinnik JA, Dinnik NN. Observations on the longevity of Haemonchus contortus larvae in the Kenya highlands. Bull. Epizootic Dis. Africa, 1961; 9: 193-208.

18. Dorny P, Symoens C, Jalila A, Vercruysse J, Sanib R. Strongyle Infections in sheep and goats under the traditional husbandry system in peninsular Malaysia. Vet. Parasitol., 1995; 56:121-136.

19. Dutt SC. Paramphistomes and paramphistomiasis indomestic ruminants in India, edited by A. Singh. Ludhiana: PAU Press, Punjab Agricultural University. 1980.x

20. Agrawal MC, Vohra S, Gupta S, Singh KP. Prevalence of helminthic infections in domestic animals in Madhya Pradesh. Journal of Veterinary Parasitology 2004; 18(2):147-149.

21. Ahmed M, Ansari JA. Prevalence of gastrointestinal nematodes of sheep and goats in Aligarh (India). Indian Vet. Med. J., 1987; 11:165-170.

22. Akram S, Najma R. Coprological examination of domestic livestock for intestinal parasites in village Bahlola, District Charsaddah (Pakistan). Pakistan Journal of Zoology, 200; 133: 344-346.

23. Alam M, Rahman A, Sen MM, Sardar SA. Subclinical gastrointestinal parasitic infection in buffaloes and its effect on haemoglobin. Livestock Advisor, 1994; 19:29-31.

24. Ankers PSF, Biaye AE. Epidemiology of helminths of cattle, sheep and goats in Maritime Guinea, Guinea. Revue-d' Elevage-et-de-Medecine-Veterinairedes-Pays-Tropicaux, 1997; 50(2):111-116.

25. Aydenzoz M, Yldz K. Prevalence of Anoplocehalidae species in sheep and cattle slaughtered in Kirikkale, Turkey. Revue de Med Vet. 2002; 154(12): 767-71.

26. Baldock FC, Arthur RJ. A survey of fasciolosis in beef cattle killed at abattoirs in southern Queensland. Aust. Vet. J., 1985; 62: 324-326.

27. Bali MK, Singh RP. Studies on the prevalence of Haemonchus contortus in sheep and goats in Hissar. Haryana Agri. Univ. J. Res., 1977; 8: 143-148.

28. Barnes EH, Dobson RJ. Population dynamics of Trichostrongylus colubriformis in sheep: computer model to simulate grazing systems and theevolution of anthelmintic resistance. Inter. J. for Parasitol., 1990; 20:823-831.

29. Belem AMG, Ouédraogo OP, Bessin R. Gastro-intestinal nematodes and cestodes of cattle in Burkina Faso Biotechnol. Agron. Soc. Environ. 2001; 5(1):17-21.

30. Charleston WAG. Trematode parasites of ruminants in New- Zealand. In Sustainable Control of internal parasites in runinants: Animal indusrries work shop (edited by Barrel, G.K.). Canterbury, New Zealand; lincaln University, 1997; 237-262.

31. Chaudhri SS, Gupta RP, Kumar S, Singh J, Sangwan AK. Epidemiology and controle of Fasciola gigantica infection of cattle and buffaloes in eastern Haryana, India. Indian Journal of Animal Sciences, 1993; 63(6): 600-605.

32. Connan RM. The effect of host lactation on a second infection of conservation value of forest fragments. International Journal of Primatology, 1972. 28:513-528.

33. Crofton HD. Nematode Parasite Populations in Sheep and on Pasture. Technical Communication of Commonwealth Bureau of Helminthology, No. 35. St Albans, England, 1963; 104 p.

34. D'Souza PE, Jagannath MS, AbdualRahman S, Prevalence of gastro-intestinal parasitism in cows and buffaloes. Indian Journal of Animal Science, 1988; 58: 748-752.

35. Diaz P, Pedreira J, Arias M, Sanchez-Andrade R, Suarez JL, Arias MS, Francisco I, Fernandez G, Diez-Banos P, Morrondo P, Paz-Silva A. Risk periods of infection by Calicophorondaubneyi (Digenea: Paramphistomidae) in cattle from oceanic climate areas. Parasitol Res., 2007; 101(2):339-342.

36. Dinnik JA, Dinnik NN. Observations on the longevity of Haemonchus contortus larvae in the Kenya highlands. Bull. Epizootic Dis. Africa, 1961; 9: 193-208.

37. Dorny P, Symoens C, Jalila A, Vercruysse J, Sanib R. Strongyle Infections in sheep and goats under the traditional husbandry system in peninsular Malaysia. Vet. Parasitol., 1995; 56:121-136.

38. Dutt SC. Paramphistomes and paramphistomiasis indomestic ruminants in India, edited by A. Singh. Ludhiana: PAU Press, Punjab Agricultural University. 1980.

39. Dutta S, Majundar P, Basak DK. Studies on the incidence of paramphistomiasis in cattle in West Bengal. Indian Journal of Veterinary Medicine, 1995; 15(2): 84-86.

40. El-Azazy OME. Seasonal changes and inhibited development of the electron microscopy in assessing the prevalence of some Setaria species in Korean cattle. KJR, 1995; 32:1–6.

41. El-Sayed HM. Helminth parasites of sheep in Dakahlia Province Egypt. Assiut Vet. Med. J., 1997; 38(75):48-54.

42. El-Shazly AMSA, El-Wafa FM, Haridy M, Soliman M, Rifaat M, Morsy TA. Fascioliasis Among Live and Slaughtered Animals in Nine Centers of Dakahlia Governorate Journal of Egypt Society Parasitological 2002; 32(1), 47-57.

43. Familton, AS, McAnulty, RW. The epidemiology of gastrointestinal parasites of sheep — back to basics. Proceedings of the 25th Seminar of the Society of Sheep and Beef Cattle Veterinarians of the New Zealand Veterinary Association, 1995; 67–73.

44. Familton AS, McAnulty RW. Life cycles and development of nematode parasites of ruminants. In: Sustainable control of internal parasites in ruminants. Ed. G.K. Barrell. Animal Industries Workshop, 1997; Chapter 6: 67-80.

45. Georgi JR, Georgi ME, Theodorides VJ. Parasitology for Veterinarians. 7th Ed, W.B. Saunder Company London. 1999.

46. Gibbs HL, Barger IA. Haemonchus contortus and other Trichostrongylid infections in periparturient, lactating and dry ewes. Vet. Parasitol., 1986; 22: 57-66.

47. Gordon HM. The epidemiology of helminthosis in sheep in winter rainfall regions of Australia. I. Preliminary observations. Australian Vet. J., 1953; 29:237-248.

48. Grant JL. The epizootiology of nematode parasites of sheep in a high rainfall area of Zimbabwe. J. S. Afri. Vete.Associ., 1981; 52: 33-37.

49. Gupta RP, Singh J. Prevalence of paramphistomes in ruminants of Karnal and Ambala districts of Haryana. Haryana Agri. Univ. J. Res., 1990; 20: 6-7.

50. Gupta RP, Yadav CL, Chaudhri SS. Epidemiology of Gastrointestinal nematodes of sheep and goats in Haryana, India. Vet. Parasitol., 1987; 24: 117-127.

51. Haridy FM, EL-Sherbiny GT, Morsy TA. Some parasitic flukes infecting farm animals in Al-Santa Centre, Gharbia Governorate, Egypt. J. Egypt. Soc. Parasitol., 2006; 36(1): 259-264.

52. Islam MR, MG Yasin, MAA Noman, Begum N, Mondal MMH. Prevalence of gastrointestinal parasites in cattle at Vangura upazila in Pabna district of Bangladesh. International Journal of Natural and Social Sciences, 2014; 1(2): 45-52.

53. Jacquiet P, Colas F, Cabaret J, Dia ML, Cheikh D, Thiam A. Dry areas: an example of seasonal evolution of helminth infection of sheep and goats in southern Moauritania. Vet. Parasitol., 1995 56:137-148.

54. Jithendran KP. Helminth parasites.A constraint in animal health management in Himachal Pradesh. Himalayan Ecology and Development, 2000; 8(2).

55. Kates KC. Survival on pasture of free-living stages of some common gastrointestinal nematodes of sheep. Proc. Helm. Soc. Washington, 1950; 17: 39-58.

56. Kaur H, Kaur D. Prevalence of gastrointestinal parasites in domestic animals of Patiala and its adjoining areas. Journal of Veterinary Parasitology, 2008; 22: 25-28.

57. Khallaayoune K, El-Hari M. Variations saisonnières de l'infestation par Fasciola hepatica chez la chèvre dans la région du Haouz (Maroc). Annales de Recherche Vétérinaire 1991; 22: 219-226.

58. Khan KNM, Rehman AU, Munir M, Khan BR. Incidence of Internal parasites of sheep in upland districts of Baluchistan. Res. Report, 1988; 18:1-17.

59. Lyons ET, Drudge JH, Tolliver SC. Epizootology of internal parasites in lambs and ewes during periparturient period in Kentucky in 1986. Proc. Helminthol. Soc. Washington, 1987; 54: 233-236.

60. Lyons ET, Tolliver SC, Drudge JH, Stamprer S. Internal parasites in a small flock of lambs and ewes during the periparturient in 1987 in Kentucky. Trans. Ky. Acad., 1992; 53:15-18.

61. Mage C, Bourgne H, Toullie JM, Rondelaud D, Dreyfuss G. Fasciola hepatica and Paramphistomum doubneyi: changesin prevalences of natural infections in cattle and in Lymnae truncauta from central France over the past 12 years. Vet. Res., 2002 33(5):439-447.

62. Maitra A, Yadav CL, Sanjukta RK. Seasonal prevalence of paramphistomosis in domestic ruminants in different agro-climatic zones of Uttarakhand, India. Asian Pac J Trop Dis, 2014; 4(Suppl 2):S748-S753.

63. Maqbool A, Hayat CS, Tanveer A., Hashmi HA. Epidemiology of fasciolosis in buffalo under different managemental conditions. Veterinarski Arhiv., 2002; 74(2):221-228.

64. Maqsood M, Iqbal Z, Chaudhry AH. Prevalence and intensity of Haemonchosis with reference to breed, sex and age of sheep and goats. Pakistan Vet. J., 1996; 124:177-195.

65. Marskole P, Verma Y, Dixit AK, Swamy M. Prevalence and burden of gastrointestinal parasites in cattle and buffaloes in Jabalpur, India, Veterinary World, 2016; 9(11): 1214-1217.

66. Md-Alam R, Ersam R, Sen AB, Das S, Md-Rahman M, Nath SK. Prevalence of gastrointestinal helminthiasis in naturally infested buffalo in Sylhet district. Int. J. Adv. Multidiscip. Res. 2016; 3(8):52-58.

67. Morgan DO, Parnell IW, Rayski C. The seasonal variations in theworm burden of Scottish hill sheep. Journal of Helminthology, 25: 1951; 177–212.

68. Pandit BA, Shaharder RA, Banday MAA, Darzi MM, Mattoo FA. Gastro-intestinal helminth parasites of cattle in Kashmir Valley. Journal of Veterinary Parasitology, 2004; 18(1):63-65.

69. Pfukenyi DM, Mukaratirwa. A retropestive study of the prevalence and seasonal variation of F.gigantica in cattleslaughtered in major abattoirs of Zimbakwe between 1990 and 1999.Orderstepoort Journal of Veterinary Research 2004; 17:181-187.

70. Phiri AM, Phiri I.K, Sikasunge CS, Monrad J. Prevalence of fasciolosis in Zambian cattle observed at selected abattoirs with emphasis on age, sex and origin. Journal of Veterinary Medicine B. Infectious Diseases of Veterinary Public Health. 2005; 52(9):414-416.

71. Phiri AK, Phir IK, Chota A, Monrad J. Trematode infections in freshwater snails and cattle from the Kafue wet lands of Zambia during a period of highest cattle-water contract. J. Helminthol., 2007; 81(1): 85-92.

72. Phiri M, Phiri IK, Monrad J. Prevalence of amphistomiasis and its association with Fasciola gigantica infections in Zambian cattle from communal grazing areas. Journal of Helminthology, 2006; 80:65-68.

73. Radostits OM, Blood DC, Gay CC. Diseases caused by Helminth parasites. pp. 1223-1230 in Veterinary medicine: A text book of diseases of cattle, sheep, pigs, goats and horses. 8th edn.London, Ballie`re Tindall. 1994.

74. Raina AK, Bhadwal MS, Raina R, Abdul R. Epidemiological studies on endoparasitic infection in dairy animals of Jammu. Life Science Reporter, 1999; 78-79.

75. Rangel-Ruiz LJ, Albores-Brahms ST, Gamboaaguilar J. Seasonal trends of Paramphistomum cevri in Tabasco, Mexico. Vet. Parasitol., 2003; 116: 217–222.

76. Regassa F, Sori T, Dhuguma R. Epidemiology of gastrointestinal parasites of ruminants in Western Oromia, Ethiopia. Intern. J. Appl. Res. Vet. Med. 2006; 4: 51-57.

77. Rolfe F, Boray JC, Nichols P, Collins GH. Epidemiology of paramphistomosis in cattle. International Journal for Parasitology, 1991; 21:813–819.

78. Roy B, Tandon V. Scanning electron microscopy of adult Eurytrema pancreaticum, a parasite of human and bovine hosts. Indian Journal of Parasitology, 1992; 16: 31-34. sheep. Proc. Helminthol. Soc. Washington, 1979; 46: 240-244.

79. Roy S, Tiwari A, Galdhar CN, Upadhyay SR, Ratre HK. Prevalence of parasitic infection in stalifed and grazing bovines of chhattosgarh. Indian Veterinary Journal, 2004; 81(3):345-347.

80. Samanta A, Santra PK, Prevalence of gastrointestinal helminths in hot and humid zone of West Bengal. J Vet Parasitol, 2007; 21:145–148

81. Sardar SA, Ehsan MA, Anower AKMM, Rahman MM, Islam MA. Incidence of liver fluke and gastrointestinal parasites in cattle. Bangladesh Journal of Veterinary Medicine, 2006; 4:39-42.

82. Sevimli FK, Kose M, Kozan E, Dogan N. Paramphistomosis and distomatosis in cattle in the Afyon province, Turkiye. arasitol. Derg, 2005; 29:43-46.

83. Singh D, Swarnkar CP, Khan F. Anthelmintic resistance in gastrointestinal nematodes of livestock in India. JVet Parasitol 2002; 16:115-130.

84. Singh A, Gangwar AK, Shinde NK, Srivastava S. Gastrointestinal parasitism in bovines of Faizabad. Journal of Veterinary Parasitology, 2008; 22:31-33.

85. Soulsby EJL. Helminths, arthropods and protozoa of domesticated animals, London, Baillience, Tindall and Cassell. 7th Ed. 1982; 14-15.

86. Southcott WH, Major GW, Barger IA. Seasonal pasture contamination and availability of nematodes for grazing sheep. Australian J. Agri. Res., 1976; 27:277-289.

87. Southey C, Hosking B. Liver fluke and tapeworm. Parasite Notes 7. A NZ Sheep Council and Merial NZ Ltd Publication. 1998; 23-26.

88. Suarz VH, Busetti MR. The epidemiology of helminth infections of Growing sheep in Argentina's Western Pampas. Int. J. Parasitol., 1995; 25:489-494.

89. Urquhart GM, Mulligan W, Jarret WFH. Lungworms in cattle. Point Veterinaire., 1985; 17(90): 287-295.

90. Vlassoff A, Sutherland IA. Variation between hosts in the developmental success of the free-living stages of trichostrongyle infections of sheep. Int. J. Parasitol., 1998; 28(9):1347-1352.

91. Yadav A, Khajuria JK, Raina AK. Gastrointestinal parasitic infection profile of bovines at R.S Pura. Journal of Veterinary Parasitology, 2005; 19:115-117.

92. Yazwinski T.A, Featherstone H. Evidence of spring and post parturient faecal nematode ova count rise in Arkansas

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