J Parasit Dis (Apr-June 2014) 38(2):201–204
DOI 10.1007/s12639-012-0212-2

ORIGINAL ARTICLE

J P D

Dicrocoeliosis in goats in Jammu, India

R. Godara · R. Katoch · Anish Yadav · M. K. Borah

Received: 12 October 2012 / Accepted: 17 November 2012 / Published online: 18 December 2012

Abstract The prevalence of dicrocoeliosis was estimated by the examination of liver of slaughtered goats ($n = 228$) brought from two major goat rearing regions (Kandi and R.S. Pura) of Jammu province of India. *Dicrocoelium dendriticum* was found in 18.9 % of the goats, with mean fluke count (±SEM) of 24.9 ± 4.4 (ranged from 0 to 478). A significant seasonal variation ($p < 0.01$) was recorded with maximum prevalence in winter (28.9 %), followed by post-rainy (22.2 %) and minimum in rainy season (9.4 %). The highest fluke count was observed in January (47.8 ± 24.6) while none of the examined animals was found positive in May and June. The origin of the goats had a significant association ($p < 0.0001$) with prevalence rates and the goats from Kandi region (27.3 %) showed higher prevalence rates as compare to R.S. Pura (8.0 %). However, the age and sex had no significant effect on the prevalence of dicrocoeliosis in goats. The histopathological examination of infected livers revealed excessive thickening and proliferation of bile duct glandular epithelium with inflammatory exudates. Also, intense mononuclear cells infiltration with young fibroblasts was observed in the surroundings of bile ducts in portal areas along with atrophy of hepatocytes.

R. Godara (✉) · R. Katoch · A. Yadav
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology-Jammu, R.S. Pura, 181 102 Jammu, India
e-mail: godara72@rediffmail.com

M. K. Borah
Department of Veterinary Pathology, Apollo College of Veterinary Medicine, Agra Road, Jamdoli, 302031 Jaipur, India

Keywords *Dicrocoelium dendriticum* · Goats · Histopathology · Jammu · Liver

Introduction

Dicrocoeliosis caused by *Dicrocoelium dendriticum*, is a widely prevalent trematodal disease in hilly regions of India (Somvanshi and Kaul 1989; Jithendran and Bhat 1996; Sharma and Godara 2010). The disease is asymptomatic and masked by the pathological effects of multiple parasitic infections in ruminants (Otranto and Traversa 2002), and is mainly reported from the sheep and goats rather than the cattle and buffaloes. In heavy infections, dicrocoeliosis causes poor weight gain, emaciation, oedema, anaemia, cirrhosis and scarring of the liver and production losses (Soulsby 1982; Jithendran and Bhat 1996). Further the zoonotic importance of the dicrocoeliosis cannot be underestimated.

The knowledge of epidemiology and the associated risk factors that are unique to a particular area and farming system will help to formulate appropriate control strategies against the parasitic disease(s). The epidemiology of the fluke diseases is closely associated with environmental factors, and ecology and the prevalence of intermediate host(s) in a particular area (Fegbemi 1984). In a certain geographical region, the climate determines the type and severity of parasitic infections in pasture grazing animals (Arambulo and Moran 1981). The aim of the present investigation was to determine the prevalence of dicrocoeliosis in goats from two ecologically different regions of Jammu province of India using abattoir examination and its associations with the variables viz. season, age, sex and origin.

Materials and methods

Study area and animals

The liver of the goats were examined at municipal slaughter house, Jammu brought for slaughter from the Kandi region (located in the foothills of the Greater Himalayas at an average altitude of 520 m above sea level) and R.S. Pura region (plain irrigated area with average altitude of 330 m above sea level) of Jammu province of Jammu and Kashmir, India, during a 12 month period from March 2010 to February 2011. The climate of the region is subtropical and humid type. The annual rainfall for the year March 2010 to February 2011 was 1,124 mm and the mean relative humidity was ranged from 37.5 % in May to 80 % in August. The mean annual minimum and maximum temperature was 10.5 (January) and 31.4 °C (June), respectively. On the basis of temperature and precipitation the area is divided into four seasons; summer (March to May), rainy (June to August), post-rainy (September to November) and winter (December to February).

On an average 19 livers of goats per month ($n = 228$, range of 13–27 animals per month) were collected during weekly visits. The distribution according to age and sex was as follows: 132 young (up to 2 years of age) and 96 adults (above 2 years of age) and 108 females and 120 males. The techniques used for the recovery and counting of flukes from the liver are as described by Sanz et al. (1987). The collected flukes were placed in plastic beakers containing 70 % ethyl alcohol and were labeled with month of collection, animal identification, sex and dental age. Few of the collected worms were flattened, fixed in 10 % formalin and stained with borax carmine for the preparation of permanent mounts and taxonomic identification according to the morphological features described by Soulsby (1982). In addition, tissue pieces of 1 cm^2 were taken from the livers of ten infected goats, fixed in 10 % neutral buffered formalin and was processed for histopathological investigations following standard techniques (Luna 1968).

Statistical analysis

The data obtained on the abattoir prevalence of dicrocoeliosis in goats according to season, age, sex and origin were compared by one-way ANOVA using SPSS 16.0 for windows. The mean worm count was obtained by dividing the total number of flukes by the total number of animals examined including non-infected ones. The season, age, sex and origin of goats were tested in binomial logistic regression and a p-value of <0.05 was considered to be significant.

Results

Observations on the liver examination

The prevalence (%) and mean worm counts (±SEM) of *D. dendriticum* in goats ($n = 228$) are presented in Table 1 and Fig. 1. The overall prevalence was 18.9 % and the worm counts varied throughout the study period, ranging from 0 to 478 with mean worm count (±SEM) of 24.9 ± 4.4. The highest prevalence was recorded in the month of December (42.9 %), followed by October (31.6 %) and January (27.8 %) whereas, none of the examined animals was found positive in May and June. The highest mean worm count (±SEM) was found in January (47.8 ± 24.6), followed by October (45.6 ± 19.7) and November (35.9 ± 20.7). Seasonally, the prevalence of the disease showed significant variation ($p < 0.010$). The highest prevalence (28.9 %) and mean worm count (35.7 ± 11.3) were found in winter and the lowest prevalence (9.4 %) and mean worm count (11.8 ± 6.6) were found in rainy season (Table 2).

As regards age, the young animals had a high prevalence rate (20.2 %) than the adults (17.4 %). However, the mean worm count (±SEM) was high in adults (26.1 ± 7.2) than the young animals (24.9 ± 5.4) and the observations were statistically not significant ($p = 0.625$). According to sex, the prevalence rate and mean worm count (±SEM) were high in the females (21.3 % and 27.9 ± 6.9, respectively) than the males (16.7 % and 22.3 ± 5.7, respectively). These differences were also not significant ($p = 0.132$).

The origin of the goats had a significant association ($p < 0.0001$) with prevalence rates (Table 2). The Kandi region had high prevalence rate (27.3 %) and mean worm count (±SEM) (35.8 ± 7.1) than the R.S. Pura region (8.0 % and 11.1 ± 4.3, respectively). More females were found infected (29.1 %) than the males (22.2 %) in Kandi region while in R.S. Pura region; the males had high prevalence (8.3 %) than the females (7.7 %). Agewise the adult goats had high prevalence (29.1 %) than the young goats (26.0 %) in Kandi region while in R.S. Pura region; young goats had high prevalence (10.6 %) than the adults (5.7 %).

Clinico-pathological observations

Grossly, the livers of the infected goats were oedematous and cirrhotic, had whitish spots and extensive scarring on the surface. The parenchyma was hardened as a result of fibrosis and calcification in severely infested goats. The histopathological examination of ten livers from infected goats revealed excessive thickening and proliferation of bile duct glandular epithelium with inflammatory exudates (Fig. 2). Intense mononuclear cells infiltration with young fibroblasts was observed in the surroundings of bile ducts

Table 1 Influence of season on the prevalence, worm counts (mean ± SEM) and worm range of *D. dendriticum* in goats

Season	No. examined	Infected (%)	Mean worm count (±SEM)	Worm range
Summer	67	16.4	19.8 ± 6.1	0–203
Rainy	53	9.4	11.8 ± 6.6	0–304
Post-rainy	63	22.2	33.8 ± 10.9	0–478
Winter	45	28.9	35.7 ± 11.3	0–401
Overall	228	18.9	24.9 ± 4.4	0–478

in portal areas (Fig. 3). Atrophy of hepatocytes was also observed in the lobules adjacent to the affected portal areas.

Discussion

The liver examination of slaughtered goats revealed 18.9 % prevalence of dicrocoeliosis. The current figure is higher than those reported by Jithendran and Bhat (1996) in slaughtered goats (12.3 %) of Himachal Pradesh, India. It could be attributed to the ecological variations in the study regions. Earlier, Khajuria and Kapoor (2003) and Yadav et al. (2006) reported a prevalence of 2.55 and 1.47 % of dicrocoeliosis in goats, respectively from the Jammu region using faecal examinations. The variation in the prevalence recorded from the same region may be due to the fact that the faecal examination is not considered a reliable method in case of dicrocoeliosis (Otranto and Traversa 2002). Further, when Jithendran and Bhat (1996) compared the faecal examination with liver necropsy, faecal examination detected the presence of dicrocoeliosis in only one out of three cases. Furthermore, in sheep with less than 100 flukes the test is usually negative (Ambrosi and Grelloni 1991).

The liver necropsy revealed the highest prevalence and worm burdens during post-rainy and winter seasons. As reported earlier, the maximum egg production occurs during January to March (Gonzalez-Lanza et al. 1993; Jithendran and Bhat 1996), when the molluscs are very abundant and active (Otranto and Traversa 2002). The infected snails could shed cercariae during late summer, which is the active period of ants. In terms of disease transmission dynamics, this is a major risk period for dicrocoeliosis in the pasture grazing nomadic goat flocks. Earlier, Jithendran and Bhat (1996) also recorded the higher prevalence of dicrocoeliosis in sheep and goats during post-rainy and winter seasons.

In the present study, the young animals had high prevalence rate than the adults. The propensity of goats in young age group to higher infection rate may be attributed to high susceptibility and low resistance. The adult animals afford some protection against reinfection due to development of immunity, which is initially low but increases with the intensity and duration of exposure of infection. However, the mean worm count was found to be higher in the adults as compared to young animals probably as the adult fluke lives more than six years which results in a gradual build-up of worm burden (Kirkwood and Peirce 1971). The higher infection rate in the females than the males could be attributed to genetic predisposition and differential susceptibility owing to hormonal effects.

The goats from Kandi region had a significantly ($p < 0.0001$) higher prevalence as compared with goats from R.S. Pura region. The variations pertaining to the prevalence of flukes in a particular region can be attributed to the prevalence of intermediate host species, beside the biology of larval stages of the flukes, and also of the intermediate hosts, is influenced to a great extent by ecological factors in that area (Fegbemi 1984). The Kandi region is lowland, having dry and calcareous soil with rain fed rivulets which remain dry during the majority part of the year and provides favourable biotopes for the survival and development of snails and ants. In such an environment, *D. dendriticum* eggs are highly resistant; they can over-winter and remain

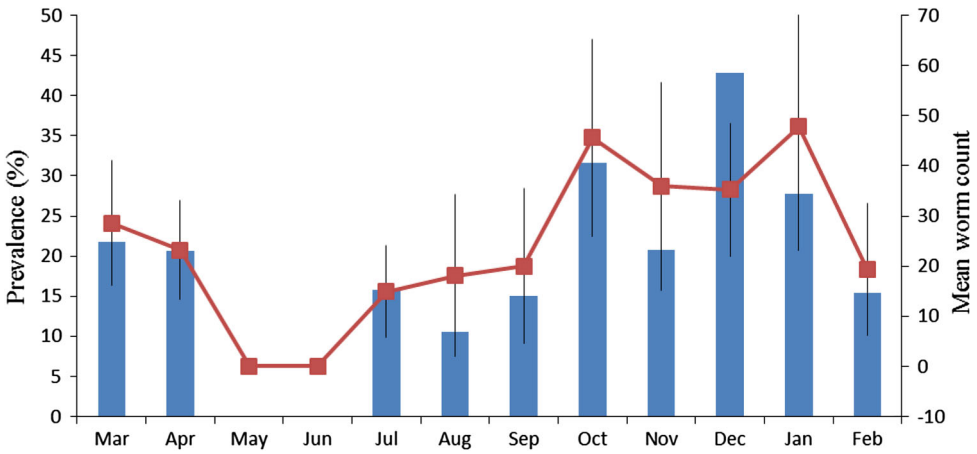

Fig. 1 The prevalence (%) and mean worm counts (±SEM) of *D. dendriticum* in goats based on abattoir examination during 2010/11

Table 2 Variables, coefficients, standard errors (SE), *p*-values and confidence intervals (CI) in goat samples included in the model

Variable	Level	Coefficient	SE	*p*-value	CI 95 % (Lower–Upper)
Intercept		−2.099	0. 543	<0.0001	
Season	Summer	−0.819	0.490	0.095	0.867–5.927
	Rainy	−1.552	0.599	0.010	1.458–15.287
	Post-rainy	−0.425	0.471	0.367	0.608–3.850
	Winter	Baseline	–	–	–
Age	Young	0.179	0.366	0.625	0.584–2.451
	Adult	Baseline	–	–	–
Sex	Female	0.557	0.369	0.132	0.278–1.182
	Male	Baseline	–	–	–
Origin	Kandi region	1.640	0.438	0.0001	0.082–0.458
	R.S. Pura region	Baseline	–	–	–

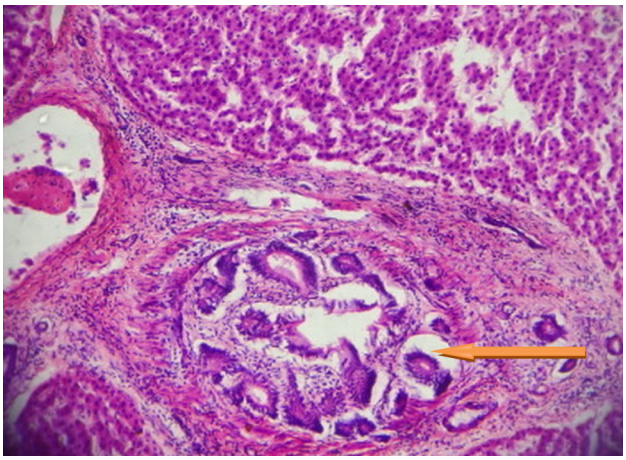

Fig. 2 Section of liver showing proliferated bile ducts (*arrow*) with inflammatory exudate mixed with fibroblast cells in portal areas (H&E, ×50)

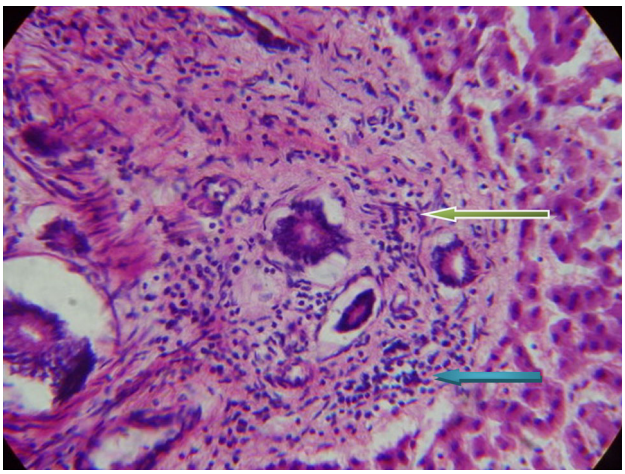

Fig. 3 Section of liver showing mononuclear cells infiltration (*blue arrow*) and young fibroblast (*green arrow*) in surrounding of bile ducts in portal area (H&E, ×400). (Color figure online)

infectious for up to 20 months on pastures (Otranto and Traversa 2003). On the other hand, R.S. Pura region is the catchment area of Chenab River, with perennial irrigation of the fields and hence unsuitable for the survival and development of the intermediate host(s) of *D. dendriticum*.

The study concludes that the season and origin are important and significant factors for predisposing dicrocoeliosis in goats. The study will initially be of great significance to understand the epidemiology of dicrocoeliosis and will be of immense help to devise appropriate control strategies to curb the disease, and to sustain the optimal growth and productivity of goats and minimise the perpetuating financial losses to resource poor communities in the region.

References

Ambrosi M, Grelloni V (1991) Use of mebendazole on the field against gastro-intestinal, hepatic and respiratory helminths in sheep. Documenti Veterinari 12:89–91

Arambulo PV, Moran M (1981) The tropics and parasitic diseases of animals-their impact on animal and human health. Int J Zoonoses 8:5–19

Fegbemi BO (1984) The effect of environmental factors on the development, behaviour and survival of *Paramphistomum microbothrium* miracidia. Vet Parasitol 16:71–81

Gonzalez-Lanza C, Manga-Gonzalez MY, Del-Pozo-Camero P (1993) Coprological study of the *Dicrocoelium dendriticum* (Digenea): egg elimination by cattle in highland areas in Leon province, northwest Spain. Parasitol Res 79:488–491

Jithendran KP, Bhat TK (1996) Prevalence of *Dicrocoelium dendriticum* in sheep and goats in Himachal Pradesh, India. Vet Parasitol 61:265–271

Khajuria JK, Kapoor PR (2003) Prevalence of parasites in sheep and goats at Kathua, Jammu. J Vet Parasitol 17:121–126

Kirkwood AC, Peirce MA (1971) The longevity of *Dicrocoelium dendriticum* in sheep. Res Vet Sci 12:588–589

Luna LG (1968) Manual of histologic staining methods of the armed forces, 3rd edn. Institute of Pathology, Mc Graw Hill Book Co, New York

Otranto D, Traversa D (2002) A review of dicrocoeliosis of ruminants including recent advances in the diagnosis and treatment. Vet Parasitol 107:317–335

Otranto D, Traversa D (2003) Dicrocoeliosis of ruminants: a little known fluke disease. Trends Parasitol 19:12–15

Sanz F, Tarazana JM, Jurado R, Friag R, Tarozana JV, Duncan JC (1987) An evaluation of the efficacy of netobimin against *Dicrocoelium dendriticum* in sheep. Vet Rec 120:57–58

Sharma RL, Godara R (2010) Metazoan diseases of livestock of greater himalayan region and their diagnosis: an overview. J Vet Parasitol 24:1–10

Somvanshi R, Kaul GL (1989) Dicrocoeliosis in pashmina goats. Indian Vet Med J 13:42–43

Soulsby EJL (1982) Helminths, Arthropods and Protozoa of Domesticated Animals, 7th edn. ELBS and Bailliere Tindal, London

Yadav A, Khajuria JK, Raina AK (2006) Seasonal prevalence of gastrointestinal parasites in sheep and goats of Jammu. J Vet Parasitol 20:65–68