



Epidemiology of *Haemonchus contortus* infection in goats in Sikkim

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ABSTRACT

Out of 3,821 faecal samples examined 63.18% were positive with a mean egg per gram (epg) of 1,150.22. Highest prevalence was observed in August (83.22%). Examination of abomasums of slaughtered goats (107) showed 61.68% incidence of *Haemonchus contortus* infection with worm count in the range of 41.26–377.22. The female/male ratio was 1.639. The infection was more prevalent in animals below 1 year (68.34%) followed by 1–2 year (64.99%) while those above two years of age showed only 57.71% prevalence. Moreover, the prevalence was more in autumn (74.73%) and summer (73.12%) compared with spring and winter.

Key words: Goats, *Haemonchus contortus*, Prevalence, Sikkim

The epidemiological study from different parts of country revealed that the incidence of haemonchosis in small ruminants varied from 56 - 80.6% (Yadav *et al.* 2006, Rahman *et al.* 2012, Demissie *et al.* 2013, Singh *et al.* 2013). Detailed epidemiological study of *Haemonchus contortus* in goats of Sikkim has not been conducted except a preliminary report on prevalence of gastrointestinal nematodosis in goats in Sikkim (Rahman *et al.* 2012). The present study, therefore, highlights the current status of *H. contortus* in goats of Sikkim on the basis of epidemiological investigation.

MATERIALS AND METHODS

Faecal samples of 3,821 goats of both sexes and different ages in 4 districts of Sikkim were collected randomly from 17 villages of subtropical high humid zone of lower altitudes of Sikkim between April 2009 to March 2011 and subjected to qualitative and quantitative examinations of *Haemonchus contortus* (Soulsby 1982) and the parasites were identified by examining the eggs (Soulsby 1982). The abomasum of 107 slaughtered goats were collected and checked for the presence of adult worms in the laboratory (Yadav and Tandon 1989) and recovered parasites were counted sex-wise. Seasonal prevalence was studied throughout the year dividing into 4 seasons, spring (March-May), summer (June-August), autumn (September-November) and winter (December-February).

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RESULTS AND DISCUSSION

Faecal samples (3,821) of goats revealed that 2,414 (63.18%) were positive for *H. contortus*, either singly or in mixed infections, during the study period with an overall

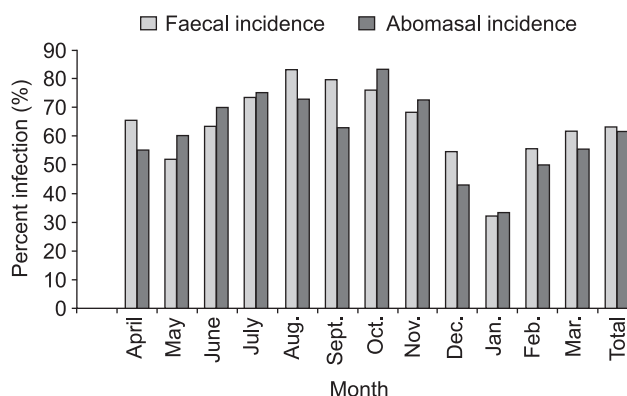


Fig. 1. Month-wise prevalence of *H. contortus* infection in the subtropical high humid zones of Sikkim.

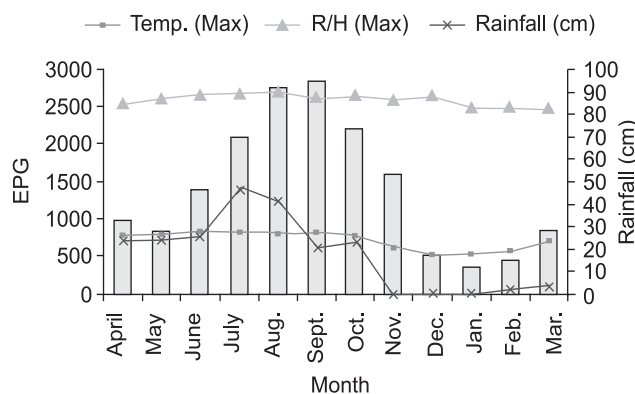


Fig. 2. Month -wise changes in eggs per gram of faeces of goats haemonchosis with respect to temperature, relative humidity and rainfall.

Table 1. Season-wise prevalence and classification of the infection degree of goats according to the EPG

Season	Sample examined	Prevalence (%)	EPG category (%)		
			Low	Moderate	Severe
Spring (March-May)	1,003	592 (59.02)	184 (18.35)	297 (29.69)	111 (11.07)
Summer (June-Aug)	945	691 (73.12)	133 (14.07)	300 (31.75)	258 (27.31)
Autumn (Sep-Nov)	938	701 (74.73)	102 (10.87)	287 (30.61)	312 (33.26)
Winter (Dec-Feb)	935	430 (45.91)	163 (17.43)	215 (23.99)	52 (5.61)
Total	3,821	2,414 (63.18)	582 (15.23)	1,099 (28.76)	733 (19.18)

Table 2. Prevalence and degree of EPG for the development of *H. contortus* in goats from the subtropical and high humid zones of Sikkim

Variables	Category	Sample examined	Prevalence (%)	EPG category (%)		
				Mild	Moderate	Severe
Age	Below 1 year	657	449 (68.34)	167 (25.42)	255 (38.81)	127 (19.33)
	Between 1-2 year	1911	1242 (64.99)	26 (14.02)	467 (24.44)	382 (19.99)
	Above 2 year	1253	723 (57.71)	117 (9.34)	357 (28.49)	274 (21.87)
Total		3821	2414 (63.18)	582 (15.23)	1099 (28.76)	733 (19.18)
Sex	Female	2987	1913 (64.04)	422 (14.13)	96 (32.31)	596 (19.95)
	Male	834	501 (60.07)	160 (19.18)	134 (16.07)	137 (16.43)
Total		3821	2414 (63.18)	582 (15.23)	1099 (28.76)	733 (19.18)

mean EPG of 1,150.22 (Table 1). The monthly observations revealed that highest rate of haemonchosis was found in August (83.22%) and lowest (32.37%) in January (Fig. 1). However, the highest mean eggs per gram (EPG) of faeces ($2,758.32 \pm 137.82$) was recorded in September with EPG ranging from 700–4,500 (Fig. 2). The significantly higher prevalence of *H. contortus* in goats might be due to the fact that this nematode has a relatively short generation interval and ability to take the advantage of favourable environmental conditions. The mean monthly maximum temperature of 18 °C or above and total monthly rainfall of 50 mm are conducive for translation and transmission of *H. contortus*. The prepatent period for *H. contortus* in small ruminants is on an average of 15 days (Soulsby 1982). Therefore, the contamination of pasture by faeces of kids/ewes produces a peak in larval availability from mid-summer and when ingested by host animals results in heavy infection capable of producing disease in late July, August and September. The larval development of *H. contortus* occurs optimally at relatively high temperatures, high humidity, microclimate of faeces and herbage and high rainfall.

A significantly higher prevalence rate was encountered during the autumn (74.73 %) and summer (73.12 %) than that of spring and winter (Table 1). The infection rate was significantly high from June to November and it reaches peak level during autumn. With the onset of winter from December onwards, the mean total epg count was steadily falling down to a minimum of 350.50 in January and after that it would accelerate slowly with the increase in temperature and rainfall (Fig. 2). The mean minimum

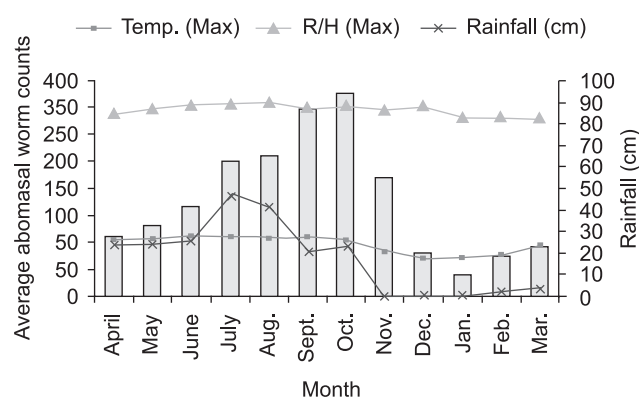


Fig. 3. Month-wise changes in average abomasal worms counts with respect to temperature, relative humidity and rainfall in the subtropical and high humid zones of Sikkim.

temperature of 7.6 °C with high relative humidity (82.42%) during winter might be responsible for arrested development of larvae, as cold stimuli are conducive to hypobiosis. The EPG pattern in present study was also similar to that of Garg *et al.* (2003), Rahman *et al.* (2012) and Singh *et al.* (2013). High rainfall and humidity lowered the resistance of animal vis-à-vis establish heavy infection in the host. Moreover, high humidity and moderate temperature during the monsoon also favoured bacterial multiplication, which was used as nutrition by free living larvae for their survivability. Further, climatic factors also influence the rate of larval movement. The high humidity and high rainfall prevailing in this region is providing suitable molarities of salt present in soil which is an important factor for ecolysis (Soulsby 1966) and prolonged survivability of nematode

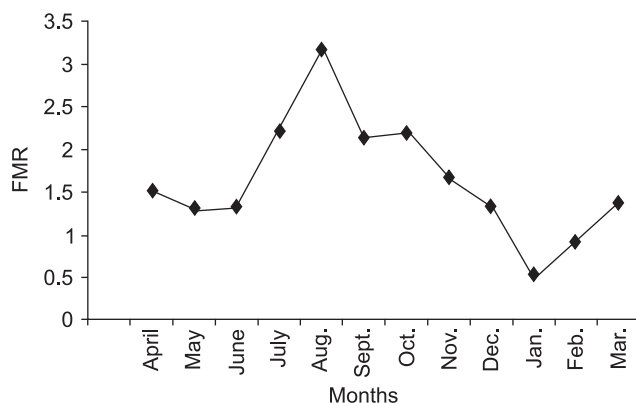


Fig. 4. Month-wise female/male ratio (FMR) of *H. contortus* in goats of subtropical and high humid zones of Sikkim.

eggs in the soil vis-a-vis increase the possibility of host infections.

Of the 107 abomasii examined, 66 were positive for *H. contortus* worms with an overall prevalence of 61.68% (Fig. 3). The average recovery per abomasum was maximum in September to October with worms range of 350.38 – 377.22±187.54 and minimum (41.26±7.76) in January. The abomasal occurrence of *H. contortus* in the present study was similar to those of Bandyopadhyay *et al.* (2010) from Shillong (Meghalaya), who described the incidence of haemonchosis in goats varying from 60.28 to 76.80 %. The incidence of abomasal infection in the present study was highest (83.22%) during summer as also reported by Garg *et al.* (2003). Abomasal worm counting revealed that female worms were more common than males. Of the worms collected from 107 abomasii, 37.89% male and 62.12% females giving an average female male ratio (FMR) of 1.639 (Fig. 4). The FMR was maximum (3.174) in August and minimum (1.50) in January. The FMR reached its peak during summer in the present study is in agreement with those of Kapur and Sood (1985) and Garg *et al.* (2003) and started to decrease lowest in winter. Our results indicated that the variation of meteorological factors have suppressive effect on egg laying, thus, regulating the FMR as a compensatory mechanism.

Younger animals tend to be more susceptible to haemonchosis as compared to adults (Table 2). Maqsood *et al.* (1996) reported that the prevalence of haemonchosis was higher in both sheep and goats less than 2 years of age compared to those of above 2 years. The prevalence of haemonchosis was higher in goats less than 1 year of age compared to those of above 1 year may be due to the fact that with the advancement of age, vigor of the animal becomes better and they develop resistance against the parasitic diseases (Qamar *et al.* 2009, Dagnachew *et al.* 2011). Relatively higher prevalence of haemonchosis was observed in female animals (64.04%) compared to male (60.07%) but the difference was not significant ($P>0.05$; Table 2). However, most of the researchers have observed higher rate of infection in female hosts (Garg *et al.* 2003, Vieira *et al.* 2014) compared with males despite similar

husbandary practice. This finding supports the general understanding of helminth infections that female animals are more susceptible of helminthosis. It is assumed that sex is a determinant factor influencing prevalence of haemonchosis and females are more prone to parasitism during pregnancy and pre-parturient period due to stress and decreased immune status (Dagnachew *et al.* 2011, Demissie *et al.* 2013).

Based on the present findings it may be suggested that broad spectrum anthelmintic treatment of goats may be given at least twice a year, once during March-May and then in August-October that could reduce the *H. contortus* infection and increase the productivity of animals in this state.

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