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Prevalence of trichostrongylids in small ruminants of Kashmir valley

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ABSTRACT

The present study was undertaken to work out the population structure of trichostrongylids affecting the small ruminants of Kashmir valley. The faecal samples were collected from each zone and sector of the valley and were examined by qualitative as well as quantitative techniques for presence of trichostrongyle eggs, followed by coproculture using petridish method for harvesting of infective larvae. The overall prevalence revealed *Haemonchus* spp. to be the most predominant trichostrongyle worm followed by *Trichostrongylus* spp., *Oesophagostomum* spp., *Teladorsagia* spp., *Chabertia* spp. and other larvae, the difference being statistically significant. In south Kashmir, a different trend was observed for trichostrongyle worms with predominance of *Trichostrongylus* spp., followed by *Haemonchus* spp., *Oesophagostomum* spp. and other larvae, the difference being statistically significant ($P<0.05$). *Teladorsagia* spp. and *Chabertia* spp. were not recorded in the south Kashmir, while as *Oesophagostomum* spp. and *Chabertia* spp. were not recorded in the north Kashmir. In small ruminants of Kashmir valley, predominance of *Haemonchus* spp. was observed in private sector farms than government sector farms, whereas predominance of *Trichostrongylus* spp. was observed in government sector farms than private sector farms, and both the difference were statistically significant. Non-significantly *Teladorsagia* spp. was found more in government sector farms than private sector farms. In government sector farms *Oesophagostomum* spp. and *Chabertia* spp. were recorded, while as in private sector farms *Oesophagostomum* spp. and *Chabertia* spp. were not recorded. It is concluded that trichostrongylid worms are prevalent throughout Kashmir valley in the small ruminants and appropriate control strategies need to be adopted for their control.

Keywords: Kashmir valley, Prevalence, Small ruminants, Trichostrongyle worms

Small ruminants suffer from various diseases among which helminth parasitism is globally considered the most important transmissible disease in sheep and goats (Sanyal 1996). In India, helminth diseases alone are responsible for 5% mortality and more than 10% morbidity in sheep (Chakraborty and Lodhi 1994). Among helminth parasitism, gastrointestinal nematodosis, is a major parasitic disease and is widely spreading in the world (Men *et al.* 2016). This is the main problem which affects sheep and goat production and causes huge economic losses in a wide range of agro-climatic zones (Waller 1997). The typical agro-climatic conditions of Kashmir valley provide a conducive environment to the growth of gastrointestinal nematodes (GIN), thereby posing the greatest challenge to the economic rearing of small ruminants. In order to control GIN infections in animals to substantially increase their body weight and productivity, the prevalence of these worms needs to be mapped out accurately, as they vary from region to region depending upon the local climatic conditions and managemental practices adopted (Fitzpatrick 2013), for development of various control measures. In Kashmir valley, the incidence of GIN infection in sheep and goats has been reported by various workers (Wani *et al*. 2011, Tramboo *et al.* 2015, Bihaqi *et al.* 2017) from few farms or places and not much emphasis has been laid on trichostrongylids, which account for major infections related to GIN. Therefore, the present study was undertaken to work out the population structure of trichostrongylids affecting the small ruminants of Kashmir valley on a large-scale considering government as well as private sector farms in every zone of valley to evolve a package of practices for control of these parasites to prevent economic losses.

MATERIALS AND METHODS

The study was conducted on sheep and goats reared at various government and private breeding farms from different regions of Kashmir valley over a period of two years (2016 to 2018). The study area comprised of three zones, viz. central, south and north Kashmir and a total of six farms from central and five each from south and north

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Table 1. Farms and number of samples with EPG ≥150

Zone	Farm and location		Small ruminant and breed		Samples (EPG ≥150)
Central	Mountain Research Centre for Sheep and Goats, SKUAST-K	Shuhama (Alusteng) District: Srinagar	Sheep	Corriedale, Hampshire, Poledorset, Bakerwal, Southdown, PC cross and Kashmir Merino	38
	Government Sheep Breeding Farm (SBF)	Dachigam District: Srinagar	Sheep	Kashmir Merino	81
	Government SBF	Kralpathri District: Budgam	Sheep	Kashmir Merino	26
	Government SBF	Goabal District: Ganderbal	Sheep	Australian Merino cross, crosses of Swarna Merino and Dorper crosses	68
	Private SBF	Zakura District: Srinagar	Sheep	Kashmir Merino cross	40
	Private SBF	Chunchur (Noorbagh) District: Srinagar	Sheep	Kashmir Merino cross	40
South	Government SBF	Daksum District: Anantnag	Sheep	Kashmir Merino	102
	Government SBF	Kewa District: Kulgam	Sheep	Kashmir Merino	10
	Government SBF	Zawoora District: Shopian	Sheep	Corriedale and Kashmir Merino	08
	Private SBF	Devalgam (Kokernag) District: Anantnag	Sheep	Kashmir Merino cross	20
	Private SBF	Kadlabal (Pampore) District: Pulwama	Sheep	Kashmir Merino cross	52
North	Government goat farm	Arin District: Bandipora	Goat	Alpine, Bakerwali, Boer, Beetal and Kajani	76
	Government SBF	Poshnar District: Kupwara	Sheep	Kashmir Merino	18
	Private SBF	Takiyaahmad Shah District: Bandipora	Sheep	Kashmir Merino cross	23
	Private goat farm	Shockbaba (Sumlar) District: Bandipora	Goat	Bakerwali	52
	Private SBF	Sulinda (Tangmarg) District: Baramulla	Sheep	Kashmir Merino cross	52

Total Zones, 3; Total farms, 16 (09 Government, 7 private); Total districts, 10; Total sheep farms, 14; Total goat farms, 2; Total samples (EPG above or equal to 150), 706.

Kashmir were screened for trichostrongylid nematodes (Table 1). Central Kashmir comprises of three districts, viz. Ganderbal, Srinagar and Budgam; South Kashmir comprises of four districts, viz. Anantnag, Kulgam, Shopian and Pulwama and North Kashmir comprises of three districts, viz. Baramulla, Kupwara and Bandipora. A total of 1,477 copro samples from small ruminants comprising of 686, 412 and 379 from each zone, respectively, were screened. Kashmir valley lies between 33°–20′ and 34°–54′ North latitude and 73°–55′ and 75°–35′ East longitude covering an area of 15,948 km^2. The temperature ranges from an average daily maximum of 31°C and minimum of

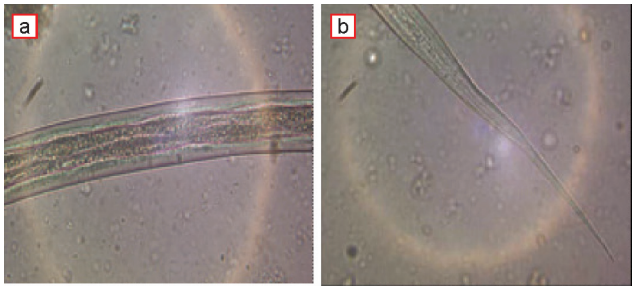

Fig. 1. Infective larva (L_3) of *Haemonchus* spp. (a) 16 rectangular intestinal cells; (b) Kink in the sheath.

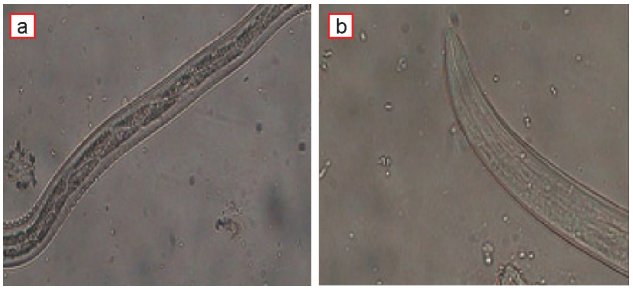

Fig. 2. Infective larva (L_3) of *Teladorsagia* spp. (a) 16 triangular intestinal cells; (b) Square shaped head.

Table 2. Overall and zone-wise prevalence of different genera of trichostrongyle worms in small ruminants of Kashmir valley

Zone	No. of larvae	*Haemonchus*	*Trichostrongylus*	*Teladorsagia*	*Oesophagostomum*	*Chabertia*	Others
Central	600	301 (50.17)^{Db}	242 (40.33)^{Cb}	17 (2.83)^{Ba}	7 (1.17)^{Aa}	4 (0.67)^{A}	29 (4.83)^{Ba}
South	300	104 (34.67)^{Ca}	160 (53.33)^{Dc}	0 (0.00)	24 (8.00)^{Bb}	0 (0.00)	12 (4.00)^{Aa}
North	400	290 (72.50)^{Dc}	85 (21.25)^{Ca}	7 (1.75)^{Aa}	0 (0.00)	0 (0.00)	18 (4.50)^{Ba}
Total	1300	695 (53.46)^{E}	487 (37.46)^{D}	24 (1.85)^{B}	31 (2.38)^{B}	4 (0.31)^{A}	59 (4.54)^{C}

Note: Figures within parenthesis indicate percentage. The values with different upper case superscript across columns in same row differ significantly (P≤0.05). The values with different small case superscript across the rows in same column differ significantly (P≤0.05).

Table 3. Overall and Sector-wise prevalence of different genera of trichostrongyle worms in small ruminants of Kashmir valley

Sector	No. of larvae	*Haemonchus*	*Trichostrongylus*	*Teladorsagia*	*Oesophagostomum*	*Chabertia*	Others
Govt. Sector	600	248 (41.33)^{Da}	271 (45.17)^{Db}	13 (2.17)^{Ba}	31 (5.17)^{C}	4 (0.67)^{A}	33 (5.50)^{Ca}
Private sector	700	447 (63.86)^{Db}	216 (30.86)^{Ca}	11 (1.57)^{Aa}	0 (0.00)	0 (0.00)	26 (3.71)^{Ba}
Total	1300	695 (53.46)^{E}	487 (37.46)^{D}	24 (1.85)^{B}	31 (2.38)^{B}	4 (0.31)^{A}	59 (4.54)^{C}

Note: Figures within parenthesis indicate percentage. The values with different upper case superscript across columns in same row differ significantly (P≤0.05). The values with different small case superscript across the rows in same column differ significantly (P≤0.5).

Fig. 3. Infective larva (L_3) of *Chabertia* spp. (a) 24–32 rectangular intestinal cells; (b) Long filiform tail.

15°C in June–July to an average daily maximum of 4°C and minimum of –4°C in January. The maximum daily humidity ranges from 80 to 90% throughout the year and drops to about 70% at night during the winter and 40% during the summer. Most of the precipitation occurs in the form of snow during winter.

Copro samples collected randomly from the rectum of small ruminants were brought to the laboratory in mini polythene bags. These were first examined by standard floatation technique (Soulsby 1982) and samples positive for trichostrongyle eggs were then examined by quantitative technique (Modified Mc Master's technique) to determine the parasitic load, i.e. EPG (eggs per gram) of faeces (Soulsby 1982). At each farm the samples having EPG ≥150 were pooled together (Table 1) and subjected to coproculture using petridish method (Sahai 1960) and the third stage larvae were harvested to find out prevalence of different genera of trichostrongylid worms using key morphological features described by Van-Wyk *et al*. (2004).

The results were subjected to standard statistical analysis as per Snedecor and Cochran (1994). The data on the prevalence of different genera of trichostrongyle worms between different groups was analyzed using 'z' test of proportions to test the significance using test equation as: $(p_1–p_2)–0/\ p(1–p)\ (1/n_1+1/n_2)$. '$p_1$' is proportion from the first population and 'p_2' is the proportion from the second population.

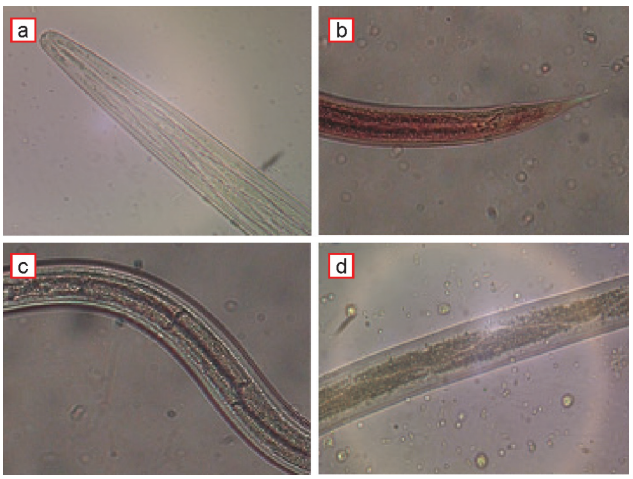

Fig. 4. Infective larvae (L_3) of *Trichostrongylus* spp. (a) Head shape is tapered; (b) No filament formation and short tail sheath; (c) Intestinal cells rectangular in *T. axei*; (d) Triangular intestinal cells in *T. columbriformis*.

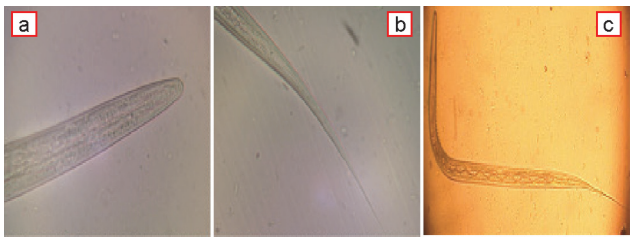

Fig. 5. Infective larva (L_3) of *Oesophagostomum* spp. (a) Head shape broad and rounded; (b) Filament is long and larva is filiform; (c) Triangular intestinal cells.

RESULTS AND DISCUSSION

The present study revealed *Haemonchus* spp. to be the most predominant trichostrongyle worm followed by *Trichostrongylus* spp., *Oesophagostomum* spp., *Teladorsagia* spp., *Chabertia* spp. and other larvae, the

difference being statistically significant (P<0.05) except between *Teladorsagia* spp. and *Oesophagostomum* spp. (Table 2 and 3; Fig. 1 to 5). Our results agree with the results of Bihaqi *et al.* (2017) who reported *Haemonchus* spp. (71.05%) as the predominant strongyle worm followed by *Trichostrongylus* spp. (12.86%), *Chabertia* spp. (8.47%) and *Ostertagia* spp. (7.62%) in caprine population of Kashmir valley. This predominance of *Haemonchus* spp. over the other strongyle worms has also been reported by Tariq *et al.* (2008 and 2010) in sheep and goats of Kashmir valley, respectively. This is because the females of *Haemonchus* spp. are prolific egg layers (Urquhart 1996) and infective stages of *Haemonchus* spp. survive for prolonged periods on pastures (Soulsby 1982).

In central Kashmir *Haemonchus* spp. was found to be the most predominant trichostrongyle worm followed by *Trichostrongylus* spp., *Teladorsagia* spp., *Oesophagostomum* spp., *Chabertia* spp. and other larvae, the difference being statistically significant (P<0.05) except between *Oesophagostomum* spp. and *Chabertia* spp. (Table 2). The results are in line with Wani *et al.* (2011) and Tramboo *et al.* (2015) with respect to predominance of *Haemonchus* spp. in the ovine populations of Ganderbal and Budgam districts of central Kashmir, respectively. Wani *et al.* (2011) reported highest prevalence for *Haemonchus* spp. (41.50) followed by *Ostertagia* spp. (28.00%), *Trichostrongylus* spp. (24.83%), *Chabertia* spp. (20.83%), *Bunostomum* spp. (14.66%), *Nematodirus* spp. (13.16%), *Oesopahagostomum* spp. (11.83%), *Trichuris* spp. (7.00%), *Gaigeria* spp. (3.33%) and *Marshallagia* spp. (3.00%) on gut studies. Tramboo *et al.* (2015) reported *Haemonchus* spp. (55.00%) as most prevalent strongyle worm followed by *Trichostrongylus* spp. (17.50%), *Ostertagia* spp. (11.67%), *Oesophagostomum* spp. (9.17%) and *Chabertia* spp. (6.67%) based on coproculture examination. Bushra *et al.* (2013), based on coprological examination, also reported *Haemonchus* spp. (33.78%) as the most predominant strongyle worm followed by *Ostertagia* spp. (21.62%), *Trichostrongylus* spp. (14.86%), *Chabertia* spp. (10.81%), *Bunostomum* spp. (8.10%), *Oesopahagostomum* spp. (6.75%), and *Cooperia* spp. (4.05%) in cattle of central Kashmir. In south Kashmir a different trend was observed for trichostrongyle worms with predominance of *Trichostrongylus* spp. followed by *Haemonchus* spp., *Oesophagostomum* spp. and other larvae, the difference being statistically significant (P<0.05). *Teladorsagia* spp. and *Chabertia* spp. were not recorded in the south Kashmir (Table 2). Maqbool *et al.* (2018) on coprological examination reported *Oesophagostomum* spp. (46%) as the most predominant strongyle worm followed by *Trichostrongylus* spp. (30%), *Haemonchus* spp. (13%) and *Chabertia* spp. (11%) in the cattle of Pulwama district of south Kashmir. Saifulislam and Taimur (2008) has also reported predominance of *Trichostrongylus* spp. over other strongyle worms in goats of Bangladesh. In north Kashmir *Haemonchus* spp. was found to be the most predominant trichostrongyle worm followed by *Trichostrongylus* spp., *Teladorsagia* spp. and other larvae, the difference being statistically significant (P<0.05). *Oesophagostomum* spp. and *Chabertia* spp. were not recorded in the north Kashmir (Table 2). Aiman *et al.* (2017), on coprological examination, also reported *Haemonchus* spp. (65%) as the most predominant strongyle worm followed by *Bunostomum* spp. (20%) and *Trichostrongylus* spp. (15%) in cattle of north Kashmir.

Predominance of *Haemonchus* spp. was observed in north Kashmir followed by central Kashmir and least in south Kashmir, the difference being statistically significant (P<0.05), whereas predominance of *Trichostrongylus* spp. and *Oesophagostomum* spp. was observed in south Kashmir followed by central Kashmir and least in north Kashmir, the difference being statistically significant (P<0.05). Non-significantly *Teladorsagia* spp. was found more in central Kashmir than north Kashmir (Table 2). The difference in the prevalence rates could be due to difference in geographical niches and the prevailing climatic conditions that vary from region to region.

In government sector farms of Kashmir valley *Trichostrongylus* spp. was found to be the most predominant trichostrongyle worm followed by *Haemonchus* spp., *Oesophagostomum* spp., *Teladorsagia* spp., *Chabertia* spp. and other larvae, the difference being statistically significant (P<0.05) except between *Trichostrongylus* spp. and *Haemonchus* spp. (Table 3). At the University goat farm of Nanaji Deshmukh Veterinary Sciences University, Jabalpur (Madhya Pradesh), Dixit *et al.* (2017) reported high prevalence of *H. contortus* (81%), followed by *Strongyloides* spp. (8%), *Oesophagostomum* spp. (6%), *Trichostrongylus* spp. (4%) and other larvae (1%). Our observations are not in line with the findings of Dixit *et al.* (2017) and the possible reason could be variation in type of climate in two regions, i.e. temperate type of climate in valley and a subtropical type of climate in Jabalpur. In private sector farms of Kashmir valley, a different trend was observed for trichostrongyle worms with predominance of *Haemonchus* spp., followed by *Trichostrongylus* spp., *Teladorsagia* spp. and other larvae, the difference being statistically significant (P<0.05). *Oesophagostomum* spp. and *Chabertia* spp. were not recorded in private sector of Kashmir valley (Table 3). Domke *et al.* (2013) and Kuchai *et al.* (2013) also recorded *Haemonchus* to be one of the most prevalent strongyle worm in sheep from Norway and Ladakh, respectively. Singh *et al.* (2013) also reported *Haemonchus* as the main GI parasite in sheep and goats in and around Mathura, India.

The study reported predominance of *Haemonchus* spp. in private sector farms than government sector farms, the difference being statistically significant (P<0.05), whereas predominance of *Trichostrongylus* spp. was observed in government sector farms than private sector farms, the difference being statistically significant (P<0.05). *Teladorsagia* spp. was found more in government sector farms than private sector farms, the difference being statistically non-significant (Table 3). The difference in the

prevalence rates could be due to the differences in the rearing and managemental practices adopted at the different sector farms.

Based on this study, it is concluded that *Haemonchus* spp., *Trichostrongylus* spp., *Oesophagostomum* spp., *Teladorsagia* spp., *Chabertia* spp. and other trichostrongylid larvae are prevalent in the small ruminant population of Kashmir valley and appropriate control strategies need to be adopted for their control to prevent economic losses.

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