Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(2): 2554-2559
© 2018 JEZS
Received: 09-01-2018
Accepted: 13-02-2018

IM Allaie
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

RA Shahardar
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

SR Tramboo
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

KH Bulbul
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

ZA Wani
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

AA Khan
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

Correspondence
IM Allaie
Division of Veterinary Parasitology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, Kashmir, India

Prevalence of Gastro-Intestinal nematodes in small ruminants of Kashmir valley

IM Allaie, RA Shahardar, SR Tramboo, KH Bulbul, ZA Wani and AA Khan

Abstract
A total of 1,477 copro samples from small ruminants of Kashmir valley comprising of 686, 412 and 379 from each zone i.e. Central, South and North Kashmir, respectively, were examined over a period of two years for presence of trichostrongyle eggs by qualitative and quantitative techniques. A total of sixteen farms were screened comprising of six farms from central and five each from south and north Kashmir. A total of 1,076 (72.85%) copro samples were found positive for trichostrongyle type of eggs including *Nematodirus*. Highest prevalence was observed in north Kashmir (78.63%) followed by south (70.87%) and central Kashmir (70.84%), the difference being statistically significant (P<0.05) except between south and central Kashmir. Overall prevalence was found more in private farms (83.55%) compared to Govt. farms (67.98%) of Kashmir valley, the difference being statistically significant (P<0.05). Overall EPG ranged from 0 to 10,550 with an average of 334.02±9.76. The average EPG was found slightly higher in the central zone (387.97±11.48) as compared to south (386.16±27.41) and least in north Kashmir (179.68±6.44), the difference being statistically significant (P<0.05) except between central and south Kashmir.The average EPG was found higher in private farms of Kashmir valley (418.40±24.03) than Govt. farms (297.39±8.86), the difference being statistically significant (P<0.05). Six farms of Kashmir valley (two each in central, south and north zone) exhibited *Nematodirus* infection among trichostrongylid positive copro-samples during qualitative and quantitative faecal examination.

Keywords: GI Nematodes, Kashmir valley, Prevalence, Small ruminants, Trichostrongylids

1. Introduction
Sheep sufficing a mutli purpose need of wool, milk, skin, meat and manure is the main source of income to the marginal farmers of the country. Goats are one of the earliest domesticated ruminants which have served mankind longer than cattle and sheep. It is reared for the production of milk, meat and hair, particularly in arid, semi-tropical or mountainous areas. In temperate, tropical and sub-tropical zones, goats are kept often as supplementary animals by small farmers. The overall development of the rural hilly areas could not be achieved by neglecting the development of the agricultural commodities like sheep and goats [1].These small ruminants suffer from various diseases among which helminth parasitism is globally considered the most important transmissible disease in sheep and goats [2]. In India helminth diseases alone are responsible for five per cent mortality and more than 10 per cent morbidity in sheep [3].Since small ruminants are very often a key component of community farming systems, helminthoses are particularly important to these farmers. Among helminth parasitism, gastrointestinal nematodosis, is a major parasitic disease and is widely spreading in the world [4].This is the main problem which affects sheep and goat production and causes huge economic losses in a wide range of agro-climatic zones [5]. The infection caused by Gastrointestinal Nematodes (GIN) in ruminants has a worldwide distribution but higher prevalences are present in temperate areas where climatic conditions favour the development of free-living stages of parasites [6].

In Jammu and Kashmir total small ruminant population is 67.14 lac i.e. sheep and goat population of 43.67 lac and 23.47 lac, respectively [7] with 16.261 lac sheep and 3.172 lac goats in the Kashmir valley [8]. The J&K state is at the 5th position with regard to sheep population in the country [7].The valley of Kashmir has typical agro- climatic conditions, having a vast exposure of natural meadows and highland pastures. These typical agro climatic conditions provide a conducive environment for many pathogenic parasites to grow and pose the greatest challenge to the economic rearing of small ruminants.

The prevalence of GINs varies from region to region depending upon local climatic conditions of the region and managemental practices adopted.

As such the parasitic fauna of each region should be mapped out accurately for developing effective control measures.It is well established fact that controlling parasitic infections in animals can substantially increase their body weight and productivity [9].In Kashmir valley, the incidence of GIN infection in sheep and goats has been reported by various workers [10, 11, 12, 13, 14, 15]but these studies are restricted to either organized farms or to sheep flocks in and around Srinagar city and no such study has been carried out on a large scale taking into account Govt. as well as Private sector farms in every zone of Kashmir valley. Therefore, the present study was undertaken to work out the prevalence of Trichostrongylid worms affecting the small ruminants of Kashmir valley to evolve a package of practices for control of these parasites in order to prevent economic losses.

2. Materials and Methods

2.1.Study area: 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 (February, 2016 to January, 2018). The study area was divided into three zones *viz*; Central, South and North Kashmir (Fig.1) and a total of six farms from Central and five each from South and North Kashmir were screened for presence of trichostrongyle eggs in faecal samples. A total of 1,477 copro samples from small ruminants comprising of 686, 412 and 379 from each zone, respectively, were screened (Table 1).

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 31ºC and minimum of 15ºC in June-July to an average daily maximum of 4ºC and minimum of -4ºC 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. The average rainfall in Srinagar is 659 mm/annum and most of the precipitation occurs in the form of snow during winter. On the basis of temperature and precipitation, four seasons are recognised in a year *viz.* winter (December to February); spring (March to May); summer (June to August) and autumn (September to November).

Central Kashmir comprises of three districts *viz.* Ganderbal, Srinagar and Budgam (Fig.1), which are situated at 34.14°N latitude and 74.47°E longitude, 34°05′N latitude and 74°50′E longitude and 34°1′12″N latitude and 74°46′48″E longitude, respectively. In central zone summers are usually mild with good little rain, but relative humidity is generally high and the nights are cool. The precipitation occurs throughout the year and no month is particularly dry. The hottest month is July (mean minimum temperature 6°C, mean maximum temperature 32°C) and the coldest is January (mean minimum temperature −15°C, mean maximum temperature 0°C). South Kashmir comprises of four districts *viz.* Anantnag, Kulgam, Shopian and Pulwama (Fig.1). The climate is temperate cum Mediterranean type. Average temperature ranges from -5°C to 32°C with average annual precipitation of about 1,040 mm in the form of rain and snow. In Daksum area of Anantnag, the climate is cold and temperate with a significant rainfall. Even in the driest month there is a lot of rain. The average temperature in Daksum is 9.9°C. About 1087 mm of precipitation falls annually. North Kashmir comprises of three districts *viz.* Baramulla, Kupwara and Bandipora (Fig.1). The north Kashmir is situated at an average height of 5226 to 5541ft. above sea level and at 74.3ºE longitude and 34.2ºN latitude. The climate is of a temperate type with cold snowy winters and pleasant weather in summer. Average minimum and maximum temperature varies from (-5 to -2.08ºC) to (16 to 23ºC). The average annual rainfall is 100.89 to 103.87 mm.

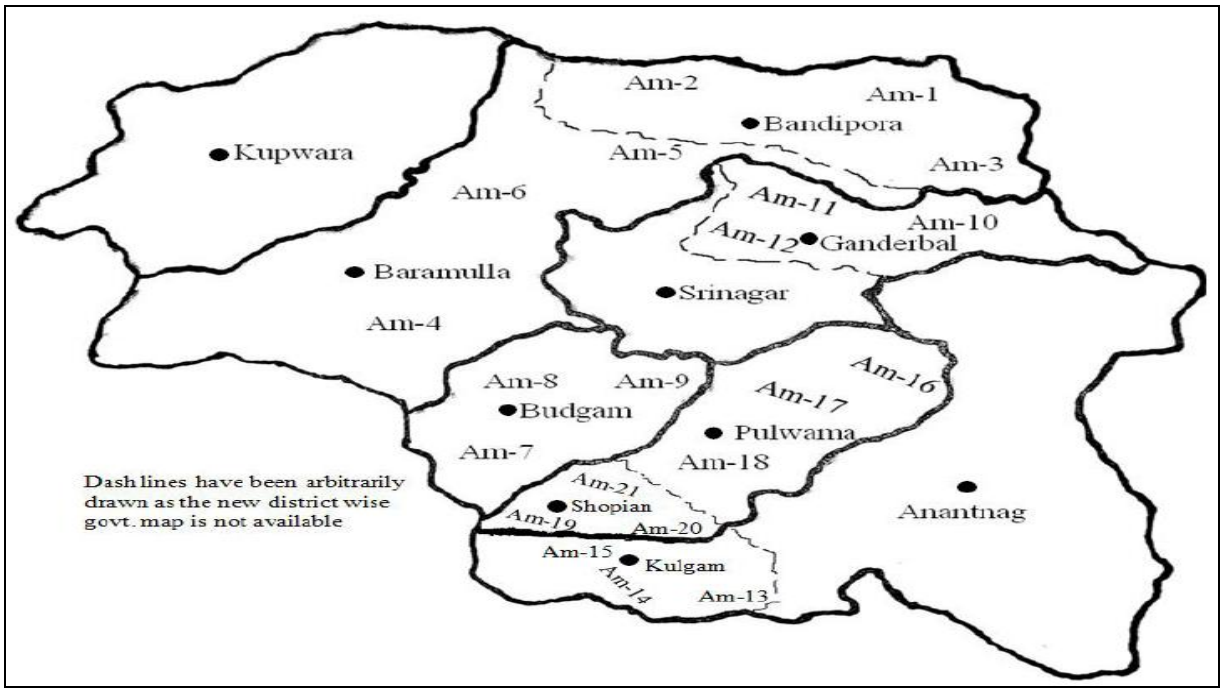

Fig 1: Map of Kashmir valley depicting sampling areas, (Retrieved from Google Images)

Table 1: Zone wise type (Govt./Private) and location of Farm, type of Small ruminant (Sheep/Goat) and Breeds screened on the Farm along with the number of copro-samples collected and number of samples positive for GIN infection (Farm wise).

Zone	Farm and Location		Small Ruminant & Breed		Samples collected	Samples positive
Central	Mountain Research Centre for Sheep & Goats, SKUAST-K.	Shuhama(Alusteng) District: Srinagar	Sheep	Corriedale, Hampshire, Poledorset, Bakerwal, Southdown, PC cross and Kashmir Merino	86	56
	Govt. Sheep Breeding Farm (SBF)	Dachigam District: Srinagar	Sheep	Kashmir Merino	120	90
	Govt. SBF	Kralpathri District: Budgam	Sheep	Kashmir Merino	104	70
	Govt. SBF	Goabal District: Ganderbal	Sheep	Australian Merino cross, crosses of Swarna Merino and Dorper crosses	200	136
	Private SBF	Zakura District: Srinagar	Sheep	Kashmir Merino cross	106	78
	Private SBF	Chunchur (Noorbagh) District: Srinagar	Sheep	Kashmir Merino cross	70	56
South	Govt. SBF	Daksum District: Anantnag	Sheep	Kashmir Merino	228	162
	Govt. SBF	Kewa District: Kulgam	Sheep	Kashmir Merino	40	20
	Govt. SBF	Zawoora District: Shopian	Sheep	Corriedale and Kashmir Merino	40	12
	Private SBF	Devalgam (Kokernag) District: Anantnag	Sheep	Kashmir Merino cross	50	46
	Private SBF	Kadlabal (Pampore) District: Pulwama	Sheep	Kashmir Merino cross	54	52
North	Govt. Goat Farm	Arin District: Bandipora	Goat	Alpine, Bakerwali, Boer, Beetal and Kajani	160	116
	Govt. SBF	Poshnar District: Kupwara	Sheep	Kashmir Merino	37	28
	Private SBF	Takiyaahmad Shah District: Bandipora	Sheep	Kashmir Merino cross	50	50
	Private Goat Farm	Shockbaba (Sumlar) District: Bandipora	Goat	Bakerwali	52	52
	Private SBF	Sulinda (Tangmarg) District: Baramulla	Sheep	Kashmir Merino cross	80	52
Total = 3 Zones	Total 16 Farms (09 Govt.; 07 Private) Total 10 Districts Screened		Total 14 Sheep Farms Total 02 Goat Farms		Total= 1,477	Total= 1,076

2.2. Parasitological Examination: The copro samples were collected randomly from adults and young sheep/goat of either sex at each farm. Copro samples were collected directly from the rectum of small ruminants and brought to the Helminthology laboratory of the Division in mini polythene bags for examination after properly labelling them. The samples were first examined grossly for colour, consistency, presence of blood, mucus and dead worms and then by standard sedimentation and floatation techniques [16].The 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 [16].

2.3. Statistical Analysis: The results were subjected to standard statistical analysis as per Snedecor and Cochran [17]. The data on the prevalence between different groups was analyzed using 'z' test of proportions. Student's 't' test was employed for analysis of two means of EPG (between different sectors) and more than two means of EPG (between different zones) were compared through ANOVA.

3. Results and Discussion

3.1. Prevalence of Trichostrongyles: The prevalence of trichostrongylids in small ruminants of Kashmir valley was studied taking into consideration the overall, zone wise and sector wise prevalence. The overall prevalence of trichostrongyles including *Nematodirus* in the present study was found to the tune of 72.85 per cent (Fig.2; Table 2). Pandit *et al.* [10] and Tariq *et al.* [11] reported overall prevalence to the tune of 59.10% (strongyle worms) and 61.60% (GIN) in sheep of Kashmir valley, respectively, while as Tariq *et al.* [12] and Bihaqi *et al.* [15] reported 54.3% (GIN) and 68.30% (strongyle worms) prevalence in goats of Kashmir valley, respectively. Strongyle infection to the tune of 67.46% and 44.62% was reported by Khajuria and Kapoor [18] and Yadav *et al.* [19], respectively in goats of Jammu while as the corresponding figure in sheep was 64.09% [18]. Wani *et al.* [20] and Allaie *et al.* [21] reported only 8.57% and 40% occurrence of strongyle type of nematode eggs in livestock of Zanaskar region of Kargil, Ladakh and in Gurez area of Kashmir valley, respectively. Maqbool *et al.* [22] reported low prevalence (26.66%) of strongyle worm eggs in pashmina goats from cold arid region of Ladakh. Shah [23] reported overall prevalence of strongyle worms to the tune of 32.39% and 31.19% in small and large ruminants, respectively, of low lying and marshy areas of Kashmir valley. The higher prevalence of nemathelminth parasites in the present study can be due to the fact that these animals are kept in close confinement, stall fed, which increases the temperature and moisture of the shed. This makes the conditions favourable for the hatching of the nematode eggs and completion of life cycle in a short period of time. This close confinement also increases the chances of transmission of infection from an

infected animal to other healthy animals.

Highest prevalence of trichostrongylid worms was observed in north Kashmir (78.63%) followed by south (70.87%) and central Kashmir (70.84%), the difference being statistically significant (P<0.05) except between south and central Kashmir (Table 2). Bhat *et al.* [24] reported only 49.0% (24.61% strongyle type worms, 15.50% *Strongyloides* and 9.0% *Nematodirus*) overall prevalence of GIN in sheep at twin farms (MRCSG, Shuhama and SBF, Dachigam) of district Srinagar. Wani *et al.* [13] and Tramboo *et al.* [14] reported 75.87% (GIN) and 57.75% (strongyle worms) prevalence in ovine population of Ganderbal and Budgam (districts of central Kashmir), respectively. The overall prevalence of strongyle worms recorded by Bushra *et al.* [25] and Aiman *et al.* [26] in cattle of central and north Kashmir was 73.85% and 49.91%, respectively. Irshad [27] recorded overall prevalence of strongyle worms in cattle of Pulwama district to the tune of 62.85%. The variation in the present study might be due to differences in geographical locations and climatic conditions of the study area, sample size and breed of animals.

Overall prevalence was found more in private farms (83.55%) compared to Govt. farms (67.98%) of Kashmir valley, the difference being statistically significant (P<0.05) (Table 2). Pandit *et al.* [28] reported highest incidence of strongyle type of nematodes (84.60%) in locally reared sheep than on organised farms (33.60%). This difference in the prevalence percentage could be due to the variation of managemental practices involved in private and Govt. sector farms.

3.2. Parasitic Load: The parasitic load of trichostrongylids in small ruminants of Kashmir valley was studied taking into consideration the overall, zone wise and sector wise egg per gram (EPG) of faeces. The overall EPG ranged from 0 to 10,550 with an average of 334.02±9.76. The average EPG was found slightly higher in the central zone (387.97±11.48) as compared to south (386.16±27.41) and least in north Kashmir (179.68±6.44), the difference being statistically significant (P<0.05) except between central and south Kashmir. The average EPG was found highest in private farms of Kashmir valley (418.40±24.03) than Govt. farms (297.39±8.86), the difference being statistically significant (P<0.05) (Fig.2; Table 3). Shah [23] reported overall average EPG of 174.48±27.65 (range 0-300) in small ruminants and 177.41±28.25 (range 0-350) in large ruminants of low lying and marshy areas of Kashmir valley. Tramboo *et al.* [14] and Bihaqi *et al.* [15] recorded an average EPG of 454.35±27.85 (range 0-1800) and 312.70±17.76 (range 0-1500) in ovine population of Budgam district of central Kashmir and caprine population of Kashmir valley, respectively. Bushra *et al.* [25] recorded 242.66±17.61 as overall EPG in cattle of central Kashmir while as Irshad [27] and Aiman *et al.* [26] in cattle of pulwama district of south Kashmir and north Kashmir recorded average EPG of 141.53±10.22 and 177.44±6.29, respectively.

3.3. Intensity of *Nematodirus* Infection: At six farms of Kashmir valley (two each in central, south and north zone) *Nematodirus* spp. infection was also observed among trichostrongylid worm positive animals. The overall prevalence of *Nematodirus* recorded in the present study was to the tune of 6.44 per cent. Highest prevalence of *Nematodirus* was recorded in central Kashmir (9.47%) followed by north (5.28%) and least in south Kashmir (2.43%), the difference being statistically significant (P<0.05). Private sector farms exhibited higher prevalence (10.82%) of *Nematodirus* than Govt. sector farms (4.43%), the difference being statistically significant (P<0.05) (Fig.3; Table 2). The average EPG of *Nematodirus* positive samples in central Kashmir at Govt. SBF, Kralipathri (samples positive = 40) and private SBF, Noorbagh (samples positive = 25) was 650.00 and 450.00, respectively. The average EPG of *Nematodirus* positive samples in south Kashmir at Govt. SBF, Daksum (samples positive = 05) and private SBF, Pampore (samples positive = 05) was 450.00 each. The average EPG of *Nematodirus* positive samples in north Kashmir at private SBF, TA Shah (samples positive = 15) and private Goat Farm, Sumlar (samples positive = 05) was 650.00 and 250.00, respectively. Our observation regarding presence of *Nematodirus* is similar to observations made by Wani *et al.* [13], who recorded 13.16% prevalence of *Nematodirus* spp. in sheep of Ganderbal district of central Kashmir. Allaie *et al.* [21] and Tramboo *et al.* [14] also reported presence of *Nematodirus* spp. from livestock in Gurez area and ovine population of district Budgam of Kashmir valley, respectively. The results regarding presence of *Nematodirus* are also in line with Maqbool *et al.* [22] and Bihaqi *et al.* [15] in pashmina goats and caprine population from cold arid region of Ladakh and Kashmir valley, respectively.

Table 2: Overall, Zone-wise and Sector-wise comparison of prevalence of GI Nematodes of small ruminants in Kashmir Valley (India)

Zone	Samples Examined		Trichostrongylid eggs including *Nematodirus*	*Nematodirus* Infection
Central	686		486 (70.84)^{a}	65 (9.47)^{c}
South	412		292 (70.87)^{a}	10 (2.43)^{a}
North	379		298 (78.63)^{b}	20 (5.28)^{b}
Overall	1,477		1076 (72.85)	95 (6.44)
Sector Wise	Govt. Sector	1,015	690 (67.98)^{a}	45 (4.43)^{a}
	Private Sector	462	386 (83.55)^{b}	50 (10.82)^{b}
	Total	1,477	1076 (72.85)	95 (6.44)

Figures within parenthesis indicate percentage. Zone wise and Sector wise values with different superscript in a column across different rows vary significantly (P<0.05).

Table 3: Overall, Zone-wise and Sector-wise comparison of parasitic load of GI Nematodes of small ruminants in Kashmir Valley (India)

Zone	Samples Examined		EPG range	Mean EPG
Central	686		0-6,925	387.97±11.48^{b}
South	412		0-10,550	386.16±27.41^{b}
North	379		0-900	179.68±6.44^{a}
Overall	1,477		0-10,550	334.02±9.76
Sector wise	Govt. Sector	1,015	0-6,925	297.39±8.86^{a}
	Private Sector	462	0-10,550	418.40±24.03^{b}
	Total	1,477	0-10,550	334.02±9.76

Zone wise and Sector wise values with different superscript in a column across different rows vary significantly (*P*<0.05).

Fig 2: Trichostrongyle eggs (view during counting in Mc Master slide)

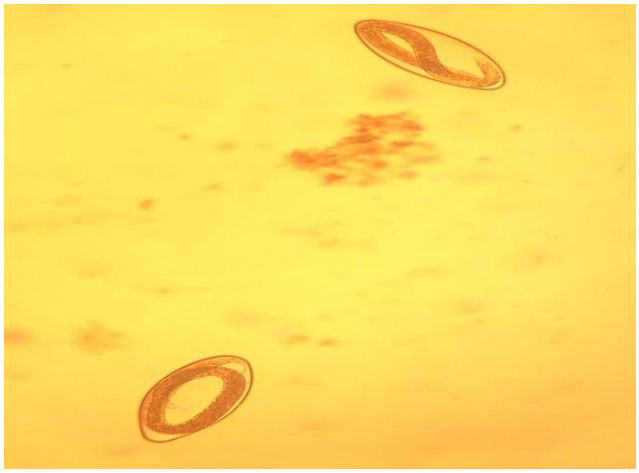

Fig 3: *Nematodirus* eggs (larva inside)

4.Conclusion

The present communication documents the prevalence of trichostrongylid worms including *Nematodirus* in small ruminants of Kashmir valley to the tune of 72.85%. The study documents slightly higher parasitic load in central zone of Kashmir valley as compared to south and least in north zone. Further the parasitic load was higher in private farms of valley than Govt. farms. This can be attributed to the poor managemental practices adopted, lack of pastures in the valley, which makes the animals to graze the same land time and again, thereby resulting in the building up of infections in animals and lack of knowledge of proper dosing methods. It is concluded that appropriate managemental practices be adopted including use of those anthelmintics which are effective against GI nematodes therapeutically as well as prophylactically to prevent production losses.

5.Aknowledgement

The authors are highly thankful to the Director (Sheep Husbandry Department, Kashmir), Joint Director Farms (Sheep Husbandry Department, Kashmir), Technical Officer (Directorate of Sheep Husbandry Department, Kashmir), In charges of all the Govt. of J&K farms including MRCSG (SKUAST-K) and Owners of all the private farms of Kashmir valley for allowing the sample collection from small ruminants present on their farms. The help and cooperation rendered by the Veterinary Asst. Surgeons and other staff of the Sheep Husbandry Department, Kashmir is highly acknowledged. The authors are also highly thankful to staff of Parasitology Division (SKUAST-K) especially to Mr. Ghulam Rasool Wani, Mr. Mohd Amin Wani, Mr. Nazir Ahmad Ganaie & Mr. Mohd. Ibrahim Bhat. The first author likes to express his special and sincere gratitude to Mr. Ghulam Rasool Wani who gave him a nice company in the laboratory during late hours in the evening and on holidays.

6. References

1. Ahmad LB, Chisti MZ, Fayaz A, Hidayatullah T. A survey of gastrointestinal helminth parasites of slaughtered sheep and goats in Ganderbal, Kashmir. Global Veterinaria. 2012; 8(4):338-341.
2. Sanyal PK. Gastrointestinal parasites and small ruminant production in India. In: Sustainable parasite control in small ruminants. L.F. LeJambre and M.R. Knox Eds. ACIAR Proceedings series. 1996; 74:109-112.
3. Chakraborty D, Lodhi C. Studies on blood and biochemical profiles in naturally infected goats. The Indian Veterinary Journal. 1994; 3: 286-288.
4. Men Q, Han H, Zhao Q, Xia W, Dong H, Zhu S. The prevalence of helminth parasites in *Pelophylax nigromaculatus* (annura: ranidae) from Shanghai, China. Acta Parasitologica. 2016; 61:802-807.
5. Waller PJ. Anthelmintic resistance. Veterinary Parasitology. 1997; 72:391-412.
6. Martínez-Valladares M, Martínez-Pérez JM, Robles-Pérez D, Cordero-Pérezb C, Famularob MR, Fernández-Patob N *et al*. The present status of anthelmintic resistance in gastrointestinal nematode infections of sheep in the northwest of Spain by *in vivo* and *in vitro* techniques. Veterinary Parasitology. 2013; 191:177-181.
7. Anonymous. 19th livestock census, All India Report, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India, 2012a.
8. Anonymous. Statistical Data. Directorate of Sheep Husbandry, Kashmir Division, Government of J&K, 2012b.
9. Fitzpatrick JL. Global food security: Impact of Veterinary Parasites and Parasitologists. Veterinary Parasitology. 2013; 195:233-248.
10. Pandit BA, Shahardar RA, Bhat AS, Darzi MM. Prevalence of gastrointestinal parasitic infection in sheep of Kashmir valley under different management practices. Applied Biological Research. 2003a; 5:1-5.
11. Tariq KA, Chisti MZ, Ahmad F, Shawl AS. Epidemiology of gastrointestinal nematodes of sheep managed under traditional husbandry system in Kashmir Valley. Veterinary Parasitology. 2008; 158:138-143.
12. Tariq KA, Chishti MZ, Ahmad F. Gastro-intestinal nematode infection of goats relative to season, host sex and age from the Kashmir valley, India. Journal of Helminthology. 2010; 84:93-97.
13. Wani ZA, Shahardar RA, Shahnawaz M. Prevalence of nemathelminth parasites in sheep of Ganderbal district of Kashmir Valley. Journal of Veterinary Parasitology. 2011; 25:26-29.
14. Tramboo SR, Shahardar RA, Allaie IM, Wani ZA, Bushra MS. Prevalence Of gastrointestinal helminth infections in ovine population of Kashmir Valley. Veterinary World. 2015; 5:667-671.
15. Bihaqi SJ, Allaie IM, Banday MAA, Wani ZA, Shahardar RA. Prevalence of caprine GI helminths in

temperate areas of Jammu and Kashmir. Journal of Parasitic Diseases. 2017; 41:843-849.
16. Soulsby EJL. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th Edition ELBS and Baillere Tindal, London, 1982.
17. Snedecor GW, Cochran WG. *Statistical methods.* 8th Edition. Iowa state University press. IOWA, USA. 1994.
18. Khajuria JK, Kapoor PR. Prevalence of parasites in sheep and goats at Kathua-Jammu. Journal of Veterinary Parasitology. 2003; 17:121-126.
19. Yadav A, Khajuria JK, Raina AK. Seasonal prevalence of gastrointestinal parasites in sheep and goats of Jammu. Journal of Veterinary Parasitology. 2006; 20:65-68.
20. Wani ZA, Allaie IM, Bushra M, Bihaqi SJ, Hussain HA, Asloob M *et al*. Occurence of parasitic infections in the livestock of Zanaskar region of Kargil, India. International Journal of Livestock Research. 2013; 3:88-91.
21. Allaie IM,Wani ZA, Shahardar RA, Maqbool I, Malik AA, Hussain HA. Parasitic fauna of livestock in Gurez area of Kashmir Valley. SKUAST Journal of Research. 2014; 16(2):143-146.
22. Maqbool I, Wani ZA, Allaie IM, Shahardar RA, Baba FA, Aiman Ashraf. Parasitic fauna infections in Pashmina goats of cold arid region of Ladakh, India. Indian Journal of Animal Sciences. 2016; 86(1):42-44.
23. Shah MM. Prevalence and Managemental Studies on Gastrointestinal Helminth Parasites of Ruminants in Low Lying and Marshy areas of Kashmir Valley. M.V.Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, 2017.
24. Bhat SA, Mir MR, Qadir S, Allaie IM, Khan HM, Husain I *et al*. Prevalence of gastrointestinal parasitic infections in Sheep of Kashmir Valley of India. Veterinary World. 2012; 5(11):667-671.
25. Bushra M, Shahardar RA, Maria A. Prevalence of gastrointestinal helminth parasites of cattle in central zone of Kashmir valley. Journal of Veterinary Parasitology. 2013; 27:33-36.
26. Aiman A, Shahardar RA, Wani ZA, Allaie IM. Prevalence of gastro-intestinal helminths in cattle at north Kashmir. Indian Journal of Animal Sciences. 2017; 87(2):147-152.
27. Irshad M. Epidemiological and Therapeutic studies on Gastrointestinal Helminth Parasites of Cattle in District Pulwama of Kashmir Valley. M.V.Sc thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, 2015.
28. Pandit BA, Shahardar RA, Darzi MM, BandayMAA, Bhat AS. Survey of gastrointestinal nematodes in sheep of Kashmir valley. Indian Journal of Small Ruminants. 2003b; 9:39-42.