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Epidemiological Studies on Gastrointestinal Helminthic Infections in Dairy Animals of Transitional Plain in Luni Basin of Rajasthan

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ABSTRACT

A total of 625 faecal samples were collected from dairy animals of transitional plain in Luni basin of Rajasthan during winter, summer and rainy season from November 2018 to October 2019. Coprological examination revealed an overall prevalence of 66.88% for gastrointestinal helminths (GIH) with mixed infection of 26.24%. Among helminths, strongyle (60.00%) showed highest prevalence followed by *Strongyloides* sp. (17.60%), *Trichuris* sp. (8.16%), amphistome (5.76%), *Moniezia* sp. (4.00%) and *Capillaria* sp. (0.48%). Native cattle (76.78%) showed a significantly higher (p<0.01) prevalence followed by crossbred cattle (67.93%) and buffaloes (55.76%). Seasonal dynamics revealed a highly significant statistical seasonal variation (p<0.01) with maximum infection in rainy season (74.29%) whereas, a non significant statistical difference in district wise prevalence was reported with the highest prevalence rate in Sirohi district (74.66%). Coprolculture analysis revealed the presence of larvae of genera *Haemonchus*, *Oesophagostomum, Trichostrongylus*, *Bunostomum* and *Strongyloides* in the decreasing order of prevalence.

HIGHLIGHTS

- To record the prevalence and intensity of gastrointestinal helminthic infections in dairy animals.
- Copro-culture was set-up to harvest and identify the infective larvae.

Keywords*:* Dairy animals, Gastrointestinal helminths, Prevalence, Rajasthan, transitional plain in Luni basin

Livestock plays a crucial role in national economy, socio-economic development of the country and agriculture. It is emerging as an important growth engine of Indian economy and share of livestock in gross domestic production has gradually risen. This sector plays a significant role in supplementing family income and generating gainful employment in rural sector, particularly, among the landless laborers, marginal farmers and women.

Gastrointestinal parasitic infections are major constraints causing huge economic losses to dairy industry owing to reduced production of animals. Losses caused by parasitic infections are lowered general health condition, retarded growth rate, reduced working efficiency, decreased milk and meat production, abortion, increased cost associated with preventive measures and reduced disease resistance capability which may ultimately lead to higher mortality (Chavhan *et al*., 2008; Silvestre *et al*., 2000). Gastrointestinal parasitic infections cause significant production losses, which may run into millions of rupees (Shah and Chaudhary, 1995). Parasitic infections cause nearly one-third of total losses due to all animal diseases (Anon, 1990). The problem is neglected because of its chronic and insidious nature (Sanyal, 1996).

Incidences of GIH infections in cattle and buffaloes have been reported from different parts of India such as Madhya

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Pradesh (Gupta *et al.*, 2012), Haryana (Chaudhri *et al.*, 2014) and Punjab (Haque *et al.*, 2011). From the state of Rajasthan, such studies or reports are scanty however, few sporadic reports are available from Rajasthan (Godara and Sharma 2010; Wadhwa *et al.*, 2011; Monika *et al.,* 2017).

Therefore, present study was designed to investigate the occurrence of gastrointestinal helminthic infections in dairy animals (cattle and buffaloes) with the objective to determine prevalence rate, types and severity of helminthic infections among dairy animals present at transitional plain in Luni basin of Rajasthan and to obtain a baseline data which will help in formulation of control and prevention strategies in near future to minimize economic losses caused by gastrointestinal helminths.

MATERIALS AND METHODS

Study area

The zone is located in southwestern part of Rajasthan. It stretches between latitude 23°4' and 27°5' and longitudes 71°4' and 74°42' and is 550 meters above mean sea level. The study area covers all tehsils of Jalore, Pali, parts of Sirohi (Sheoganj and Reodar tehsils) and Jodhpur districts (Luni and Bilara tehsils). The average rainfall of the region varies from 300 to 500 mm and the maximum temperature goes beyond 39.7° during summer and lowers up 5.3° during winter (D.O.A., Govt. of Rajasthan, www.agriculture.rajasthan.gov.in).

Collection of faecal samples

A total of 625 faecal samples of dairy animals comprising of native cattle (224), crossbred cattle (184) and buffaloes (217) were collected randomly from the four districts of transitional plain in Luni basin of Rajasthan during winter, summer and rainy seasons from November 2018 to October 2019.The samples were placed in sterile polythene bags and labelled carefully indicating the host's detail, location and season of collection, kept in a cool transport box and brought to the Laboratory for further examination.

Coprological examination

The faecal samples were qualitatively examined by using centrifugal flotation and sedimentation techniques for detection of helminths eggs (Soulsby, 1982) and quantitatively by modified McMaster egg counting technique (Coles *et al*. 1992). Copro-culture study was also performed to harvest and identify strongyle larvae (Wyk and Mayhew, 2013).

STATISTICAL ANALYSIS

Statistical analysis was performed by using SPSS 20.0 software by applying Chi square (χ^2) test and subjected to the multivariate binary logistic regression model with significant association at $p \leq 0.05$ (two-side).

RESULTS AND DISCUSSION

Overall Prevalence

An overall prevalence of 66.88% for GIH infection was recorded during present study which is in compliance with the reports from different states of India viz Maharashtra (Shirale *et al.*, 2008), Madhya Pradesh (Gupta *et al.*, 2012), Tamil Nadu (Vanisri *et al.,* 2016) and from around the world viz Thailand (Yuwajita *et al*., 2014), Ethopia (Regassa *et al.,* 2006) and Belgium (Agneessens *et al.*, 2000). Contrary to present findings, a comparatively lower prevalence was recorded by Wadhwa *et al*. (2011) and Monika *et al.* (2017) from Rajasthan state whereas, a higher prevalence was reported by Singh *et al.*, 2008 and Bushra *et al.* (2013) from Uttar Pradesh and Kashmir, respectively. The variations in prevalence rate could be attributed to the difference in number of faecal samples examined, period of study and geoclimatic conditions like temperature, rainfall and humidity etc. that affect the survival of infective stage of parasites and intermediate hosts, managemental conditions and deworming practices of the study animals in a region.

Among various helminth infections reported, strongyle types infection (60.00%) showed highest prevalence followed by *Strongyloides* sp (17.60%), *Trichuris* sp. (8.16%), amphistomes (5.76%), and *Moniezia* sp. (4.00%) whereas, meager infection of *Capillaria* sp. (0.48%) was also reported (Fig. 1). Various parasites reported from dairy animals in the present investigation are in congruence to the previous findings of Wadhwa *et al.* (2011); Swarnakar *et al.* (2015); Monika *et al.* (2017) from various parts of Rajasthan. Similar findings were also reported from

Jammu (Singh *et al*., 2009), Punjab (Haque *et al*., 2011), Madhya Pradesh (Gupta *et al.*, 2012), Sikkim (Rahman *et al.*, 2012), Meghalaya (Laha *et al.*, 2013) and Kashmir (Bushra *et al.,* 2013). Zaman *et al.* (2014) and Vanisri *et al*. (2016) reported higher infection of nematode parasites as compared to trematodes and cestodes which is in agreement with the findings of present study. The high prevalence may be due to favorable climatic conditions, constant exposure of infestation and availability of infective stage larvae on the grazing ground by animals.

a = strongyle., b = *Strongyloides* sp., c = *Trichuris* sp., d = *Capillaria* sp., e = Amphistome, f = *Moniezia* sp.

Fig. 1. Photomicrographs of gastrointestinal helminths eggs (40X)

Animal type wise analysis

Animal type wise analysis revealed highest prevalence in native cattle (76.78%) followed by crossbred cattle (67.93%) and buffaloes (55.76%) (Table 1) with a highly significant difference (p<0.01). Among various infections reported in the study, strongyles was reported as the most dominants infection with the highest prevalence in native cattle is congruent to the previous findings of Chaudhri *et al*. (2014); Monika *et al.* (2017). Statistical analysis using multivariate binary logistic regression revealed a negative association in crossbred cattle and buffalo i.e. odd ratio of infection decreased by 0.782 and 0.604 in crossbred cattle and buffalo as compared to native cattle (Table 3). The higher prevalence in native cattle may be attributed to longer periods of communal grazing which increase the chances of exposure to infective stages of parasites along with marginal husbandry care of native cattle as compared to crossbred and buffaloes which are usually stall fed. (Renwal *et al.,* 2017 and Monika *et al.,* 2017).

Seasonal dynamics

Seasonal dynamics revealed highly significant difference (p<0.01) with highest prevalence during the rainy season (74.29%) followed by summer (67.77%) and winter (58.00%) seasons (Table 2). Seasonal dynamics of gastrointestinal helminth infections revealed highest prevalence during rainy season (74.29%) which is congruent to the reports of Monika *et al.* (2017); Choudhary *et al.* (2018); Gupta *et al.* (2012) and Singh *et al.* (2008). Statistical analysis using multivariate binary logistic regression model revealed a positive association in rainy and summer seasons i.e. odd ratio of infections increased by 1.431 and 1.286 during rainy and summer seasons as compared to winter season (Table 3). The highest prevalence in rainy season might be due to more suitable environmental conditions in terms of humidity and temperature for the development of pre-parasitic

Table 1: Overall prevalence of gastrointestinal helminths in dairy animals

		Examined	Infected	Mixed infection	Gastrointestinal helminthes					
					Strongyle	*Strongyloides* sp.	*Trichuris* sp.	Amphistome	*Moniezia* sp.	*Capillaria* sp.
Cattle	Native	224	172 (76.78)	68 (30.08)	152 (67.85)	45 (20.08)	32 (14.28)	13 (5.80)	15 (6.69)	3 (1.32)
	Crossbred	184	125 (67.93)	46 (25.00)	113 (61.41)	33 (17.93)	9 (4.89)	3 (1.63)	4 (2.17)	—
Buffaloes		217	121 (55.76)	45 (20.73)	110 (50.69)	32 (14.74)	10 (4.60)	20 (9.21)	6 (2.76)	—
χ^2 *value*		—	22.128**	5.404	13.750**	2.190	17.492**	16.558**	6.701*	—
Total		625	418 (66.88)	164 (26.24)	375 (60.00)	110 (17.60)	51 (8.16)	36 (5.76)	25 (4.00)	3 (0.48)

Note: Figures in parentheses indicate percentage,*= significant, **= highly significant.

Table 2: Season and district wise prevalence of gastrointestinal helminths in dairy animals

		Examined	Infected	Mixed infection	Gastrointestinal helminthes					
					Strongyle	*Strongyloides* sp.	*Trichuris* sp.	Amphistome	*Moniezia* sp.	*Capillaria* sp.
Season	Winter	200	116 (58.00)	40 (20.00)	102 (51.00)	35 (17.50)	15 (7.5)	—	2 (1.00)	—
	Summer	211	143 (67.77)	53 (25.17)	127 (60.18)	33 (15.63)	12 (5.68)	13 (6.16)	6 (2.84)	1 (0.47)
	Rainy	214	159 (74.29)	71 (33.17)	146 (68.22)	42 (19.62)	24 (11.21)	23 (10.74)	17 (7.94)	2 (0.93)
χ^2 *value*			12.513**	9.482**	12.784**	1.166	4.503	22.094**	14.091**	1.891
District	Jodhpur	154	95 (61.68)	24 (15.58)	83 (53.89)	25 (16.23)	5 (3.24)	3 (1.94)	—	—
	Pali	145	95 (65.51)	29 (20.00)	80 (55.17)	23 (15.86)	9 (6.20)	10 (6.89)	3 (2.06)	—
	Jalore	176	116 (65.90)	48 (27.27)	105 (59.65)	36 (20..45)	25 (14.20)	10 (5.68)	15 (8.52)	2 (1.13)
	Sirohi	150	112 (74.66)	63 (42.00)	107 (71.33)	26 (17.33)	12 (8.00)	13 (8.66)	7 (4.66)	1 (0.66)
χ^2 *value*			6.176	31.298**	11.835**	1.496	14.284**	6.804	17.374**	3.139
Total		625	418 (66.88)	164 (26.24)	375 (60.00)	110 (17.60)	51 (8.16)	36 (5.76)	25 (4.00)	3 (0.48)

Table 3: Multivariate binary logistic regression for gastrointestinal helminths in dairy animals

	Parameter	Logistic regression coefficient (B)	S.E.	Wald test	P value	Odd ratio
Season	Winter	—	—	11.095	0.004	—
	Rainy	0.358	0.109	10.772	0.001	1.431
	Summer	0.252	0.112	5.035	0.025	1.286
District	Sirohi	—	—	10.034	0.018	—
	Jalore	-0.156	0.134	1.362	0.243	0.855
	Jodhpur	-0.398	0.127	9.839	0.002	0.671
	Pali	-0.146	0.131	1.244	0.265	0.864
Animal-type	Native cattle	—	—	19.855	0.000	—
	Crossbred cattle	-0.246	0.120	4.197	0.040	0.782
	Buffalo	-0.504	0.114	19.537	0.000	0.604
Constant		-1.373	0.115	141.624	0.000	0.253

stages of most of parasitic nematodes, whereas cold and dry climate have destructive effects on the development of the helminthic stages and allow fewer pre infective larvae to reach the infective stage (Soulsby, 1982).

District wise analysis

A statistically non-significant difference was reported among four districts with highest prevalence in Sirohi district (74.66%) followed by Jalore (65.90%), Pali (65.51%) and Jodhpur district (61.68%) (Table 2). Statistical analysis divulged a negative association in prevalence among Jalore, Jodhpur and Pali districts as compared to Sirohi district i.e. odd ratio of infection decreased by 0.855, 0.671 and 0.864 in Jalore, Jodhpur and Pali districts respectively (Table 3). The reason behind minute variation may be due to similarity in pasture management, climatic conditions, communal grazing and water sources (Monika *et al.,* 2017; Renwal *et al.*, 2017).

Intensity of GIH infection

Intensity of the gastrointestinal helminths infections in dairy animals as eggs per gram (epg) were depicted in Table 4. Highest intensity was recorded for native cattle during present study followed by crossbred cattle and buffaloes. Variations may be due to the difference in number of faecal samples examined, period of study and geoclimatic conditions like temperature, rainfall and humidity etc that favor survival of infective stage, managemental condition and deworming practices of the respective study areas. Highest epg was recorded during rainy season in present study which is in compliance with the findings of Choudhary *et al.* (2018). The reason for high epg during rainy season may be the environmental

Table 4: Intensity of gastrointestinal helminths in dairy animals as eggs per gram(Mean±S.E.)

	Intensity of gastrointestinal helminths			
	Strongyle (Range)	***Strongyloides* sp. (Range)**	***Trichuris* sp. (Range)**	***Moniezia* sp. (Range)**
Native cattle	200-800 (503.03±87.56)	100-500 (340±74.63)	300-700 (500±70.7)	200-500 (340±50.98)
Crossbred cattle	200-500 (320±36.36)	100-300 (360±96.59)	200-300 (240±18.7)	100-200 (150±22.36)
Buffalo	100-300 (205±25.21)	100-200 (150±22.36)	200-300 (250±22.36)	100-400 (230±53.84)

Table 5: Mean measurements (μm) of 3rd stage strongyle type larvae in dairy animals (Mean±S.E.)

Nematodes	**Total length (Range)**	**Extension of tail sheath beyond tail (Range)**	**Intestinal cell no. and shape**	**Salient features**
Haemonchus sp.	822.10 ±5.14 (772.14-864.25)	65.63±0.84 (57.22-74.38)	16 Triangular	Narrow bullet shaped head, the pointed tail of larva and tail sheath is usually 'kinked' (Fig. 6)
Oesophagostomum sp.	775.02±9.39 (725-870)	143.13±2.47 (20.18-30.25)	18-22 Triangular	Long tail ending in a long fine filament (Fig. 5)
Trichostrongylus sp.	667.81±9.4 (624.25-735.18)	24.46±0.72 (20.18-30.25)	16 Triangular	The tail sheath is conical and blunt at the tip. (Fig. 3)
Bunostomum sp.	529.66±3.93 (510-550.70)	65.43±2.25 (52.23-81.18)	16 Triangular	Short straight larvae with wide body sudden tapering to long thin tail. (Fig. 2)
Strongyloides sp.	642.77±15.41 (580-715)	—	—	No sheath and slender body with long oesophagus 1/3 to ½ of the total length of larvae. (Fig. 4)

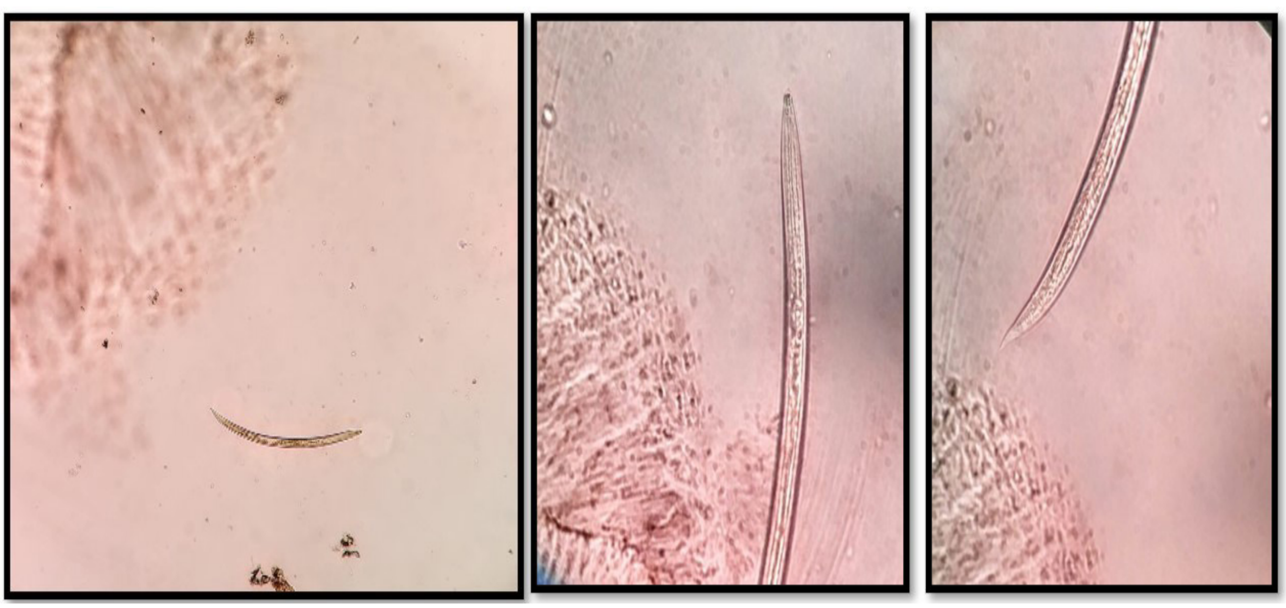

Fig. 2. Larvae of *Bunostomum* sp.

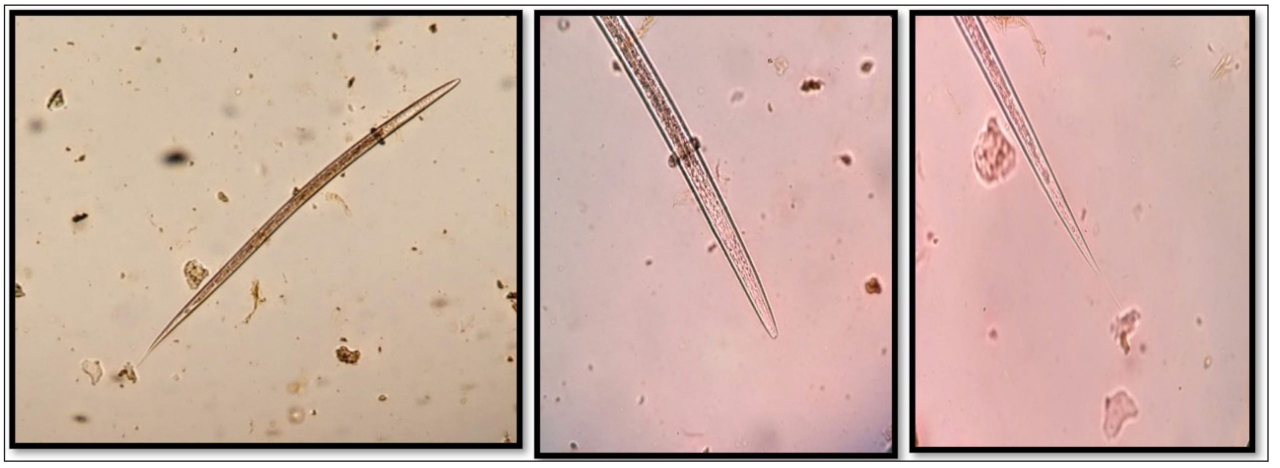

Fig. 3: Larvae of *Trichostrongylu* ssp.

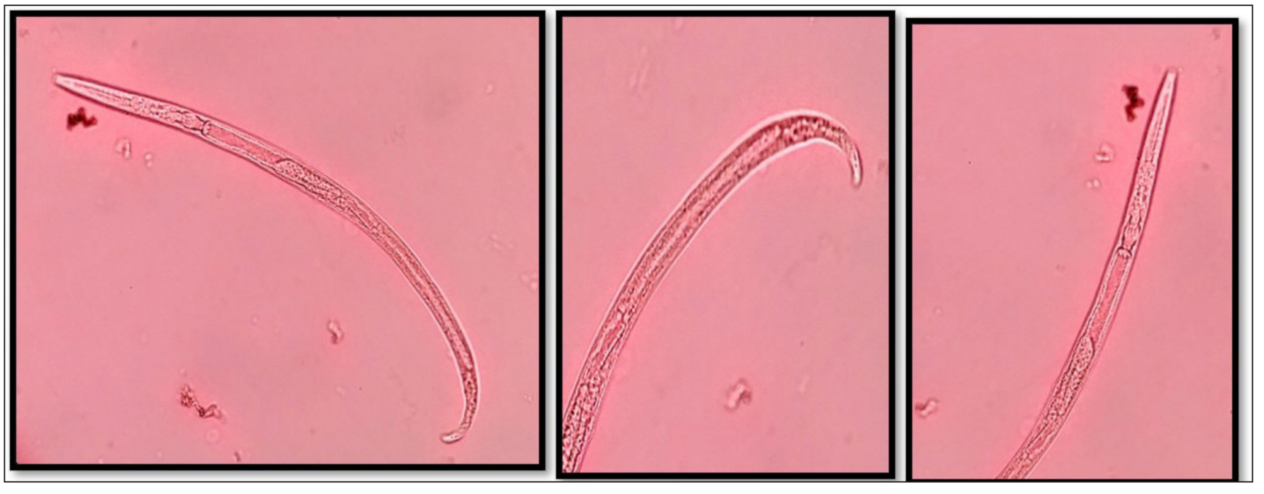

Fig. 4: Larvae of *Strongyloide* ssp.

Fig. 5: Larvae of *Oesophagostomum* sp.

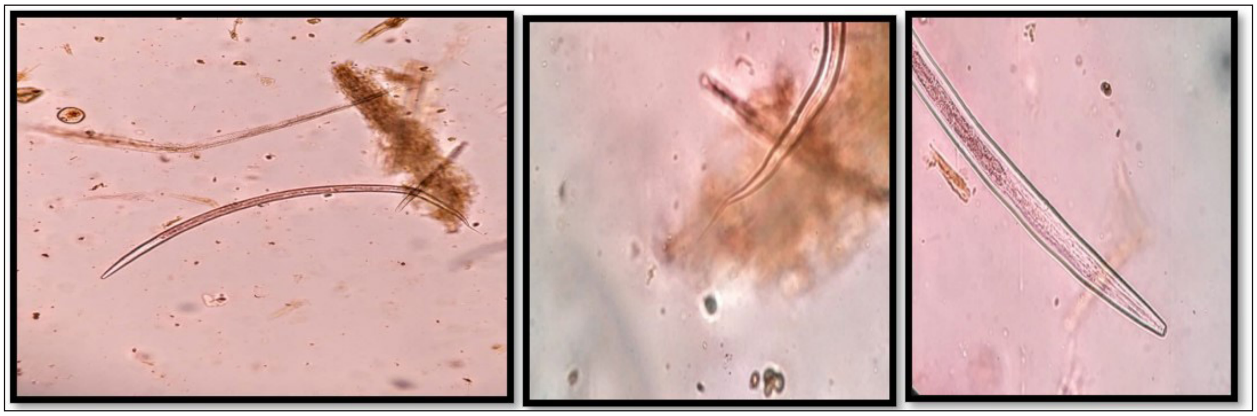

Fig. 6: Larvae of *Haemonchus* sp.

condition (temperature and humidity) of this region which facilitate the development and survival of the pre-parasitic stages (Durie, 1961), leading to increased parasite burden on host and pasture. Parasite egg and oocyst counts reflect the ability of host to regulate the survival/expulsion, growth, or reproduction of parasites to which it has been exposed (Soulsby, 1982).

Coproculture

Coproculture analysis revealed *Haemonchus* (34.75%) as predominant species, followed by *Oesophagostomum* sp. (24.00%), *Trichostrongylus* sp. (17.25%), *Bunostomum* sp. (15.00%) and *Strongyloides* sp. (9.00%). *Haemonchus* sp. was reported to be highest during rainy season whereas *Strongyloides* sp., *Oesophagostomum* sp. and *Trichostrongylus* sp. were found to be higher during summer season with complete details in table 5. Various researchers in their respective studies on cattle and buffalo population have encountered these nematodes (Monika *et al.,* 2017; Renwal *et al.*, 2017; Choudhary *et al.*, 2018) from Rajasthan and different parts of India (Jithendran and Bhat, 1999; Muraleedharan, 2005).

CONCLUSION

It can thus be concluded that the effects of various factors (season, animal-type and district) on the prevalence of GIH infection in dairy animals is significant and hence the data generated could be of immense help in formulation of effective strategies for GIH control.

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