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EPIDEMIOLOGY AND MANAGEMENT OF GASTROINTESTINAL NEMATODES IN YOUNG SHEEP AT AN ORGANISED FARM IN SEMIARID RAJASTHAN

D. Singh* and C.P. Swarnkar
Division of Animal Health
Central Sheep and Wool research Institute, Avikanagar-304 501, Rajasthan
**E-mail address: dherindra.singh56@gmail.com*

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ABSTRACT

The profile of predominant gastrointestinal strongyle worm (*Haemonchus contortus*) was studied in young sheep at naïve and exposed stages in order to ascertain the source of infection and to formulate suitable targeted treatment strategy. Lambs born during the major lambing season (December to February) were used for investigation. From 2004 to 2011, a total of 2397 sheep (6-7 months of age) belonging to Malpura and Avikalin breeds were evaluated for intensity of strongyle infection at monthly intervals during wormy season (from July to November). A total of 10058 faecal samples were examined by the modified McMaster technique. The overall monthly mean faecal egg count (FEC) varied significantly ($P<0.001$) from 9.1±3.1 (July) to 3959.0±213.4 epg (September) in males and from 8.7±3.0 (July) to 3157.2±177.3 epg in females of Malpura breed. Likewise in Avikalin sheep it ranged from 12.9±3.7 (July) to 3913.7±203.0 epg (September) and from 12.0±2.9 (July) to 4038.5±232.3 epg (September) in males and females, respectively. Significant ($P<0.05$) variation in mean FECs were observed between the breeds from August to October. The effect of year was significant ($P<0.001$) for all the monthly FECs in both the breeds. It was concluded that in semi-arid conditions of Rajasthan, young sheep (born during spring season) of marketable age could be raised without anthelmintics till July and (gastrointestinal nematode) GIN infection in them could be effectively managed by a single anthelmintic intervention during late monsoon. (**Indian Journal of Small Ruminants 2012, 18(2): 220-224).**

Key words: Epidemiology, Gastrointestinal nematodes, Management, Rajasthan, Sheep

As per 18th Livestock Census (2007) there are about 71.5 million sheep in India and about 1.2 million people are involved in sheep rearing in addition to 1.3 million people in wool processing (GOI, 2006). In recent years, the country has observed dramatic change in the trends of small ruminant production and consumption of their products. The mutton component in sheep rearing is main produce to get regular income not only for farmers but also to entrepreneurs and middlemen. Among the diseases that constraint the survival and productivity of small ruminants, gastrointestinal nematodes (GIN) infection ranks highest on a global index with *Haemonchus contortus* being of overwhelming importance (Perry et al., 2002). Based on sheep population (Anon., 2003) of Rajasthan, Singh et al. (2011) estimated an annual loss of Rs 217.993 million (Rs 94.29/head/annum) due to GIN in young sheep of Rajasthan and the components of losses were comprised of decreased mutton production (75.42%), pre-disposition to mortality (11.25%), increased premature disposal (11.23%) and decreased wool production (2.10%). The problem of GIN is usually tackled predominantly by the frequent use of chemotherapeutics; however, this strategy received set a back because of rampant rise in emergence of anthelmintic resistant strains of nematode parasites (Singh and Swarnkar, 2008) as well as rising demand of chemical-free animal products by consumers. Among the various approaches to worm management, chemotherapeutic strategies based on epidemiological profile of worms still have top place in effective management of

infection in livestock. The present study was aimed to observe the profile of predominant gastrointestinal strongyle worm (*Haemonchus contortus*) in young sheep at unexposed and exposed stages in order to ascertain the source of infection and to formulate suitable targeted treatment strategy for them.

MATERIALS AND METHODS

All the lambs belonging to Malpura and Avikalin (Rambouillet X Malpura) breeds and born during the major lambing season (December to February) at the Central Sheep and Wool Research Institute, Avikanagar (Rajasthan) were used for the present study. From the year 2004 to 2011, a total of 2397 sheep (6-7 month old) reared under semi-intensive production system were evaluated for intensity of strongyle infection at monthly intervals during the wormy season (from July to November). Following birth of lambs, weaning was done at the age of 3 months and weaned lambs were allowed to graze on those pastures which were earlier grazed by the adult ewes. Each year the primary infection of strongyle worms in young sheep was terminated in the month of September using tetramisole or closantel on annual rotation basis. A total of 10058 faecal samples were collected per rectum at unexposed (July to September) and exposed (October-November) stages and quantitatively evaluated by the modified McMaster technique using saturated sodium chloride solution (MAFF, 1984). The data on faecal egg count (FEC) were analyzed to observe the effect of breed, month, year, and sex by analysis of variance using SPSS 16.0.

RESULTS AND DISCUSSION

Significant ($P<0.05$) variation in the mean FECs was observed between the breeds from August to October and Avikalin sheep were found to have higher intensity of strongyle infection compared to the native Malpura sheep. The effect of year was significant ($P<0.001$) for all the monthly FECs in both the breeds (Table 1). Similarly, yearly variation in intensity of strongyle infection was reported from the farm (Prince et al., 2010) and the field flocks (Swarnkar et al., 2010).

Table 1. Comparative mean (±SE) faecal egg counts for strongyle worms in Malpura and Avikalin young sheep

Year	Malpura					Avikalin				
	Jul	Aug	Sep	Oct	Nov	Jul	Aug	Sep	Oct	Nov
2004	1.0^{b}	52.3^{e}	1393.7^{d}	-	415.7^{ef}	2.2^{b}	5.4^{d}	1846.2^{c}	-	1597.4^{b}
	±0.7	±19.0	±97.2		±49.4	±1.6	±2.8	±199.4		±131.8
2005	00^{b}	528.6^{d}	26.6^{e}	768.2^{cd}	3610.6^{a}	7.5^{b}	740.0^{c}	693.3^{d}	2501.9^{a}	2499.0^{a}
	±70.3	±6.5	±64.2	±280.1	±5.6	±99.8	±97.3	±343.0	±294.0	
2006	0.9^{b}	6.4^{e}	7506.8^{a}	1114.2^{bc}	271.7^{f}	4.4^{b}	47.3^{d}	6075.5^{a}	1092.9^{cd}	543.4^{c}
	±0.9	±2.7	±532.8	±228.3	±26.3	±3.7	±15.1	±347.2	±75.5	±49.7
2007	4.0^{b}	2295.3^{b}	5551.4^{b}	2238.4^{a}	2143.4^{b}	17.1^{b}	3266.4^{b}	6560.4^{a}	1280.4^{cd}	1373.3^{b}
	±1.9	±154.9	±374.1	±213.2	±167.0	±6.1	±324.2	±525.4	±120.8	±146.8
2008	7.0^{b}	4180.2^{a}	609.3^{de}	529.4^{de}	780.2^{d}	12.3^{b}	4819.0^{a}	547.2^{d}	717.1^{de}	723.6^{c}
	±2.4	±249.9	±68.3	±47.0	63.6	±5.0	±327.3	±73.1	±108.6	±103.4
2009	14.8^{b}	7.1^{e}	2933.0^{c}	800.0^{cd}	655.0^{de}	00^{b}	14.0^{d}	5847.9^{a}	1993.6^{ab}	1375.0^{b}
	±8.6	±2.5	±164.4	±72.0	±57.7		±5.0	±495.6	±262.1	±155.4
2010	1.2^{b}	5.8^{e}	4639.2^{b}	213.8^{e}	208.1^{f}	0.9^{b}	7.8^{d}	3753.2^{b}	246.2^{e}	347.6^{c}
	±0.8	±1.7	±411.2	±26.2	±24.7	±0.9	±2.8	±352.6	±83.1	±60.0
2011	44.2^{a}	1115.6^{c}	7003.3^{a}	1485.8^{b}	1146.8^{c}	60.9^{a}	2970.0^{b}	6408.9^{a}	1490.7^{bc}	1282.2^{b}
	±14.0	±108.2	±614.2	±337.8	±128.2	±17.0	±379.2	±552.7	±427.5	±240.4
Overall	9.2	1038.6	3544.3	975.4	1077.0	12.5	1476.2	3973.7	1312.3	1153.5
	±2.1	±58.1	±137.9	±62.0	±52.1	±2.4	±95.4	±153.5	±85.7	±60.8

Means with different superscripts within columns differ significantly ($P<0.001$) from each other

Over the years observations revealed that sex had significant (P<0.05) influence on intensity of strongyle infection for the months of August and September (unexposed stage) in Malpura breed. The overall monthly mean FECs varied from 9.1±3.1 (July) to 3959.0±213.4 epg (September) in males and from 8.7±3.0 (July) to 3157.2±177.3 epg in females of Malpura breed (Table 2).

Table 2. Mean (±SE) faecal egg counts for strongyle worms in Malpura young sheep

Month	Year								
	2004	2005	2006	2007	2008	2009	2010	2011	Overall
	A. Males								
Jul	2.0	00	00	3.9	10.3	9.2	2.8	42.1	9.7
	±1.4			±2.2	±3.9	±3.3	±2.0	±20.3	±3.1
Aug	85.7	522.0	7.3	2087.2	4886.1	7.1	7.4	1351.9	1166.8
	±35.0	±78.0	±5.1	±168.8	±361.2	±4.1	±2.9	±141.5	±87.0
Sep	1685.9	37.0	10800.0	5355.7	760.0	3144.3	5186.8	7057.1	3959.0
	±147.5	±10.0	±878.1	±509.1	±129.8	±238.8	±646.2	±909.3	±213.4
Oct	-	883.3	1100.0	1755.1	619.1	965.1	238.0	1842.2	1036.9
		±103.8	±315.2	±188.6	±76.3	±114.8	±29.0	±620.3	±96.4
Nov	630.2	2130.5	393.9	1945.7	1038.6	784.6	247.9	1417.2	1041.1
	±90.4	±205.7	±48.5	±208.9	±110.8	±93.9	±28.4	±191.5	±55.2
	B. Females								
Jul	00	00	1.5	4.1	3.8	20.3	00	47.1	8.7
			±1.5	±3.0	±2.8	±16.5		±18.7	±3.0
Aug	13.3	534.3	5.6	2523.9	3513.2	7.1	4.6	853.4	915.6
	±3.9	±113.5	±2.8	±265.7	±333.1	±2.8	±2.0	±161.2	±77.2
Sep	1072.2	18.6	5224.4	5770.0	479.0	2721.6	4232.4	6956.3	3175.2
	±115.5	±8.5	±533.4	±554.5	±57.5	±225.0	±531.3	839.3	±177.3
Oct	-	676.0	1122.5	2721.7	458.8	640.5	195.9	1123.2	924.2
		±79.3	±313.1	±375.1	±58.0	±85.1	±40.2	±255.8	±80.4
Nov	201.2	4806.9	180.5	2353.0	581.1	557.0	180.2	889.1	1107.1
	±24.0	±431.4	±24.1	±262.7	±65.2	±71.0	±36.9	±166.6	±83.9

On the other hand, in Avikalin breed, sex had significant (P<0.001) effect on the mean FECs for the month of October and November (exposed stage). In similar management and agro-climatic conditions, Swarnkar et al. (1996) and Singh et al. (1997) observed a peak in intensity of strongyle infection in young sheep in September. It was observed that males had higher intensity of infection compared to the females and the overall monthly mean FECs ranged from 12.9±2.7 (July) to 3913.7±203.0 epg (September) and from 12.0±2.9 (July) to 4.38.5±232.3 epg (September) in males and females, respectively (Table 3). Similar effect of sex on FECs was also reported by Prince et al. (2010) in Avikalin sheep.

In the present study year and sex interaction was inconsistent and there was significant (P<0.05) effect on mean FECs for September and November in 2004, 2006; for November in 2005; for October in 2007, 2009; for August to November in 2008, 2011 while remained non-significant during 2010 in Malpura lambs. Similarly in Avikalin lambs, year and sex interaction revealed significant effect (P<0.05) on mean FECs for November in 2004; for September in 2005; for October and November in 2006, 2009, 2011; for September to November in 2008; for August in 2010, while remained non-significant during 2007. These year to year variations could be attributed to variation in environmental conditions (rainfall,

humidity and temperature) as genetic and sheep management was similar between years. Based on bioclimatographs, Swarnkar and Singh (2011) also reported year to year variation in span of period favourable for translation of GINs in Rajasthan.

Table 3. Mean (±SE) faecal egg counts for strongyle worms in Avikalin young sheep

Month	Year								
	2004	2005	2006	2007	2008	2009	2010	2011	Overall
					A. Males				
Jul	00	9.8	7.7	18.5	11.1	00	00	65.9	12.9
		±9.8	±6.5	±11.5	±4.0			±29.3	±3.7
Aug	7.3	823.2	59.0	3220.4	5217.1	14.7	13.6	2962.3	1613.8
	±4.4	±175.3	±25.3	±533.7	±425.6	±9.6	±5.1	±511.0	±141.0
Sep	1685.5	1042.3	6329.3	5625.0	730.1	5762.9	4132.1	6835.4	3913.7
	±218.5	±170.7	±445.6	±797.2	±116.2	±724.3	±344.3	±829.7	±203.0
Oct	-	3095.9	1327.4	1164.2	908.6	2668.6	301.9	3065.8	1608.4
		±680.4	±111.6	±147.5	±180.6	±594.3	±142.2	±903.8	±152.6
Nov	1902.2	2432.6	696.4	1354.2	979.0	1890.6	267.3	2306.0	1346.6
	±177.3	±360.4	±71.3	205.2	±157.6	±306.7	±39.4	±452.5	±87.1
					B. Females				
Jul	5.6	5.1	00	15.8	13.7	00	2.0	56.5	12.0
	±3.9	±5.1		±4.9	±10.1		±2.0	±19.1	±2.9
Aug	2.6	653.7	32.3	3310.7	4213.0	13.6	1.8	2978.7	1324.5
	±2.6	±91.5	±12.2	±380.0	±504.2	±5.6	±1.8	±570.6	±126.5
Sep	2079.0	350.9	5710.5	7461.1	280.0	5898.3	3374.3	6022.6	4038.5
	±372.2	±70.2	±554.2	±673.2	±35.8	±667.1	±614.9	±741.5	±232.3
Oct	-	2000.0	747.4	1394.4	464.2	1593.2	172.5	243.8	1005.7
		±254.3	±67.0	±190.8	±69.9	±212.8	±49.0	±90.4	±71.0
Nov	1130.0	2553.6	331.7	1389.5	343.1	1057.7	436.0	384.2	949.6
	±162.9	±449.2	±55.6	±209.8	±79.0	±152.1	±117.8	±131.6	±83.7

Prevailing agro-climatic conditions and sheep rearing practices (Swarnkar and Singh, 2010) in Rajasthan provide ideal conditions for the transmission and build-up of strongyle infection in sheep flocks only during July to mid-September. The study revealed that in semi-arid conditions of Rajasthan, young sheep of marketable age remained almost free from strongyle infection up to July. The pasture contaminated by adult sheep during monsoon was found main source of infection for young sheep during August (mid monsoon). Following strategic termination of primary infection during September, the rate of re-infection was quite low and subsequent winter climate was unsuitable for further propagation of infection (Singh et al., 1997; Swarnkar et al., 2008; Swarnkar and Singh, 2011). In addition the lower intensity of infection in exposed lambs could also be due to development of immunity in lambs against GIN after initial exposure and advancement of age (Reinemeyer, 1995; Vlassoff et al., 2001). The occurrence of peak intensity of strongyle infection during late monsoon in lambs is relatively constant observation over the period in semi-arid area of Rajasthan and this may prove to be of considerable practical significance. The findings could be utilized in minimizing the anthelmintic treatment in lambs (more vulnerable to infection) by targeting during late monsoon. Further under farm conditions, if provision of summer rested pasture could be made then there may be possibility to get low level of infection in lambs.

Such integration of epidemiological findings and pasture management could help to raise lambs for mutton production without anthelmintic treatment as well as able to maintain quantum of refugia and decrease the rate of selection pressure for emergence of anthelmintic resistant strains of nematodes.

It was concluded that young sheep (born during spring season) of marketable age in semi-arid conditions of Rajasthan could be raised without anthelmintics till July and GIN infection in them could be effectively managed by single anthelmintic intervention during late monsoon.

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