

Short Communication

Impact of climatological parameters on prevalence of gastrointestinal helminths of small ruminants in Tamil Nadu

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India with staggering 61 million sheep and 124 million goats contributing \$US 140 million to livestock industry every year in the form of skin, hide, wool and meat. Of the several infectious diseases affecting sheep and goats gastrointestinal helminthic infection is one of the economically important health impediment (Sanyal and Gour, 1984) affecting growth rate and milk productions (Hoste and Chartier, 1993). As scanty information is available on the level of helminthic infection of small ruminants in this part of the sub-continent (Sanyal and Gour, 1984 and Raman *et al.*, 1999), a detailed epidemiological studies were carried out from 2001 to 2012 in various agro-climatic zones of Tamil Nadu as part of the All India Network Programme on Gastro Intestinal Parasitism funded by Indian Council of Agricultural Research, New Delhi.

In addition, the influence of various meteorological parameters like rainfall, relative humidity and atmospheric temperature on egg count of various helminthic parasites of sheep and goats in the seven agro-climatic zones of Tamil Nadu were interpreted to predict their impact on the prevalence of gastro-intestinal helminths.

Collection of faecal samples

About 50 g of fresh faecal sample were collected per rectum from sheep and goats maintained in organized farms and in private holdings from seven agro climatic zones of Tamil Nadu during different season from January 2001 to December 2012. Ninety faecal samples were collected from sheep and goats from each zone in a season and thus 2520 faecal samples were collected in seven agro climatic zones during the four seasons of Tamil Nadu in a year, thus totaling to 28,590 samples during the entire study period.

Egg count and meteorological parameters

The faecal samples collected as above were processed for egg count by cuvette method using polyallomer test tubes and expressed as eggs per gram of faeces (EPG). The

meteorological parameters such as the mean maximum and mean minimum air temperature, mean relative humidity and total rainfall were collected for Chennai (North eastern zone), Coimbatore (Western), Salem (North western), Kodaikanal (High altitude), Kanyakumari and Nagapattinam (High rain fall), Tiruchirappalli (Cauvery Delta) Madurai (Southern districts) representing the seven agro climatic zones of Tamil Nadu from the Regional Meteorological Centre, Nungambakkam, Chennai.

Data analysis was done by correlating the mean egg counts with the above said meteorological parameters using multiple linear regression analysis (Using SPSS® 20.0 version for windows®) to assess the impact of climatological factors on egg count in the seven agroclimatic zones of Tamil Nadu using the formula.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + \mu$$

Where, Y= EPG, a= constant, b= parameter, X₁= mean maximum temperature (Tmax), X₂= rainfall, X₃= relative humidity (RH) and μ= error

The results indicated that out of the 28,590 faecal samples examined 14335 samples were from sheep and 14255 samples were from goats. In sheep 9107 (63.5 %) samples were found positive for different helminthic infection whereas in goat 8043 (56.4%) samples were found to be positive. Nematode infection was predominantly observed both in sheep (38.3%) and goats (42.7%) (Table 1).

Of the four seasons, a higher egg count was observed in Northeast monsoon (75.1%), followed by South west monsoon (64.6%) and least infection in summer (49.1%) in small ruminants of the helminthic infection, significant nematode infection was noticed during Northeast monsoon (42.4 %) with moderate trematode infection during summer (19.7%). Higher egg output recorded in monsoon season seems to be coinciding with prevailing conducive climatic condition that lead to development of pre-parasitic stages of infective stages inside the host (Sanyal, 1989).

Table 1: Prevalence of gastrointestinal helminths in sheep and goat in Tamil Nadu during 2001 to 2012

	Sheep		Goat	
	No of animals	Per cent (%)	No of animals	Per cent (%)
1 Number of animals screened	14335	-	14255	-
2 Positive samples	9107	63.5	8043	56.4
3 Trematodes infection	1400	15.4	1262	15.7
4 Cestode infection	1050	11.5	1084	13.5
5 Nematode infection	3484	38.3	3430	42.7
6 Mixed infection	1967	21.6	1517	18.9

Table 2 : Regression analysis between climatic factors and egg per gram of faecal (EPG)

Variable	North eastern zone	North western zone	Western zone	High altitude zone	High rainfall zone	Cauvery delta zone	Southern zone
Constant (a)	692.968 (2.335)	131.734 (0.936)	263.236 (4.727)	351.607 (6.269)	312.142 (3.615)	196.938 (1.896)	34.813 (1.055)
Tmax (X ₁)	-8.836 ^{NS} (-1.796)	-3.280 ^{NS} (-1.587)	-5.017 [*] (-2.245)	-1.544 ^{NS} (-1.570)	-1.711 ^{NS} (-1.210)	-1.693 ^{NS} (-0.911)	2.139 ^{**} (4.149)
Rain fall (X ₂)	0.121 ^{**} (3.036)	-0.027 ^{NS} (-0.496)	-0.011 ^{NS} (-0.319)	0.015 ^{NS} (1.784)	0.017 ^{NS} (0.651)	0.007 ^{NS} (0.167)	0.098 ^{**} (3.915)
RH (X ₃)	-2.313 ^{NS} (-1.246)	1.861 ^{NS} (1.615)	0.002 ^{NS} (0.005)	-0.147 ^{NS} (-0.449)	-0.267 ^{NS} (-0.465)	0.169 ^{NS} (0.265)	1.091 ^{**} (3.174)
F-value	5.25 ^{**}	5.49 ^{**}	2.83 [*]	4.28 ^{**}	2.91 [*]	2.88 [*]	15.19 ^{**}

Note. ** - $p < 0.01$, * - $p < 0.05$, NS - $p > 0.05$

Effect of meteorological parameters on egg count

The effects of mean maximum air temperature, relative humidity and total rainfall on EPG were assessed by multiple linear regression model (Table 2). A positive correlation was observed between egg count and rainfall, while in most of the agro climatic zones of Tamil Nadu, a negative impact on the egg count was found with mean maximum atmospheric temperature (Ram *et al.*, 2007). Rather, rainfall and moisture status seem to have the most important effect. In Northeastern and Southern zones of Tamil Nadu, it was found that the worm burden was directly proportional to rainfall (Jithendran, 1998 and Katoch *et al.*, 2000). Nevertheless, various climatic factors on the egg count varied within the seven agroclimatic zones of Tamil Nadu as depicted in Table 2. Hence it was predicted that for every mm rise in rainfall, there might be a significant rise in the egg count in North eastern and Southern zones. In Northeastern zones of Tamil Nadu interaction between observed climatic variables like temperature and relative humidity is highly significant with the predicted values of larval survival rate and egg count.

An increase in EPG is highly correlated ($P < 0.01$) with the increase in rainfall and relative humidity and decrease in temperature (Singh *et al.*, 2005) and is in accordance with the findings of Tripathi (1970). Incidence of high egg count was found to be directly proportional to low mean atmospheric temperature and high relative humidity (Hawkins, 1945).

The EPG pattern in present study was similar to that of Katoch *et al.* (2000) who recorded the highest incidence of GI nematodes in rainy season with the highest EPG count. Higher rate of infection in rainy months may be attributed to suitable molarity of salt present in soil which is an important factor for ecdysis (Soulsby, 1982). According to Hawkins (1945) heavy rainfall and high relative humidity predispose to heavy parasitic infections. Climatic factors also influence in larval dispersion on the herbage which increases the chance of contact between host and larvae (Ogbourne, 1972 and Croll, 1975). The significantly low EPG was recorded with respect to high atmospheric temperature in western region of Tamil Nadu. During winter season reduced

faecal egg output/count was observed (Chapman, 1982), indirectly by reducing the grazing period of animals, thus lowering the chances of infection resulting in decreased output of faecal eggs (Singh *et al.*, 2005). In contrary, Pazhanivel *et al.* (2004) observed that seasons had not play much important role in the prevalence of GI nematodes and also reported that the infection was slightly more during winter followed by Northeast monsoon due to continuous persistence of worms in the host as well as pasture all the year around. However, higher rate of strongyle infection was observed during Northeast monsoon followed by Southwest monsoon and winter with least infection during summer season. The higher rate of strongyle infection observed during Northeast and Southwest monsoon is understandable due to the availability of lush herbage pasture on account of continuous rainfall with low atmospheric temperature prevailing during those period (Raman *et al.* 2010).

In conclusion, we found that of all the agro-climatic zones of Tamil Nadu, the faecal egg count showed significantly positive correlation with the rainfall. Higher EPG value of faeces was observed during Southwest Monsoon. The decrease in EPG in most of the zones was highly correlated with the increase in temperature. In our study significantly low EPG was recorded in Western region of Tamil Nadu with respect to high atmospheric temperature. In Southern region of Tamil Nadu EPG significantly increased with increase in parameters like total rainfall and mean relative humidity.

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