



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(7): 922-925
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Received: 05-07-2021
Accepted: 19-07-2021

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Prevalence of theileriosis in large ruminants of Uttarakhand

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Abstract

Bovine theileriosis, an economically important disease of domesticated livestock in tropical and subtropical countries of world is caused by several *Theileria* sp. belonging to the Phylum Apicomplexa. In the present study, blood samples of large ruminants suspected for theileriosis infection were received from different veterinary hospitals from July, 2019 to June, 2021. They were microscopically examined using Giemsa stain. The blood samples were recorded on the basis of season, breed, age and sex. A total of 1006 blood samples were collected, out of which 20.77% samples were found infected with theileriosis. Cattle (24.13%) were found more prone to theileriosis infection than buffalo (10.71%). The season wise analysis revealed highest prevalence in summer season (29.07%) followed by rainy (16.44%) and winter (4.34%). The age wise prevalence was found highest in adult (25.62%) followed by heifers (22.14%) and <1 years (8.38%) of age. The study revealed that female animals harbored more infection than males and cross bred, were found more infected than indigenous livestock. From the study, it was concluded that indigenous breed and younger animal population were less prone to infection than cross bred and older population. Additional care and managerial practices are required in livestock farming to avoid economic losses due to high theileriosis infection in summer and rainy season.

Keywords: Prevalence, theileriosis, cattle, buffalo

Introduction

Ticks are of great importance to livestock and wildlife health since they act as a vector of many infectious agents along with causing direct injury by piercing host's skin (Khabou *et al.*, 2021) [8]. In tropical and sub-tropical countries, ticks and tick borne diseases cause significant adverse effects on livestock population. Variation in the environmental condition in past few years has resulted in increased temperature and humidity which is the favorable condition for the development and multiplication of ticks and hence leads to gradual increase in tick borne diseases in livestock (Kohli *et al.*, 2014b) [11]. Theileriosis is one of the economically important haemoprotozoan diseases of large ruminants caused by protozoa of *Theileria* genus transmitted by Ixodid ticks leading to heavy economic losses in terms of morbidity, mortality and decreased milk production in recovered animals. Risk factor associated with stress on ruminants includes low nutrition, high production, poor hygiene and sanitation and increased rate of acaricidal resistance which intensified the adverse impact of theileriosis (Sahoo, *et al.*, 2017) [17]. Prior reports of theileriosis infection from different selective areas of Uttarakhand have been submitted by Rialch *et al.*, 2013 [16]; Kohli *et al.*, 2014a [10]; Kohli *et al.*, 2014b [11]; Arun *et al.*, 2018 [3] and Nagar, 2018 [12]. The present study was conducted to know the prevalence of theileriosis season, age, breed and sex wise in large ruminants of different zones of Uttarakhand.

Material and Methods

Study Area and Population

The study was conducted in two different zones of Uttarakhand i.e. Kumaun region (District Udham Singh Nagar, Nainital and Champawat) and Garhwal region (District Dehradun, Haridwar and Pauri) for a period of two years from July 2019 to June 2021. Under this study prevalence of theileriosis in large ruminants (cattle and buffalo) were recorded with respect to their breed, age and sex of animals along with season and location of animals. Among the cattle, there was two breeds i.e. indigenous cattle and Holstein Friesian (HF) crossbred while upgraded Murrah Buffalo was recorded in the study area. On the basis of their age they are grouped into 3 groups i.e. up to 1 year of age (calves), 1-3 years of age (heifers) and >3 years (Adult).

Blood samples of 1006 animals (cattle and 754 and buffalo 252) clinically suspected for theileriosis having symptoms like fever, anorexia, lacrymation and salivation were screened from different districts of Uttarakhand, India.

The year was divided into three seasons - summer (March to June), rainy (July to October) and winter (November to February). Tick samples were also collected along with blood from suspected animals.

Collection and Microscopic Examination of Blood Samples

Approximately 1 ml of blood sample was collected from Juglar Vein into BD Vacutainer® tube containing EDTA from the animals suspected for theileriosis and stored at 4°C for further examination. Blood samples were received from Teaching Veterinary Hospital, Pantnagar and from different Veterinary Hospitals of Uttarakhand region and were microscopically examined in Department of Veterinary Parasitology, GBPUA&T, Pantnagar by Giemsa staining method. Blood smears were carefully examined for the presence of *Theileria* sp. piroplasm under oil immersion lens (100 x magnification) (Soulsby, 1982) [18]. The level of parasitemia was classified as per the method given by Ishihara's in Japanese literature: no detection (-); 1 parasite in 10 fields (+); >1 parasite in 10 fields (++) ; >1 parasite in 1 field (+++) and more than 10 parasites in 1 field (+++) (Jain, 1993) [5].

Tick identification and counts

Tick identification and its count were done in those animals which were found infected with theileriosis after getting thin blood smear examination report. Clinical examination of infected animal for the tick count was done after parting the hairs in opposition to their natural direction. Ticks were not randomly distributed on the body of animal but rather limited to few predilection sites; so we preferred to count all the ticks on one side of the body of animal rather than counting per square meter (Kivaria *et al.*, 2012) [9]. Tick count estimation of each positive animal was done by searching the ticks from head to tail on their right saggital plane and the number of ticks collected from the saggital plane of the animal X 2 (Alvarez *et al.*, 2003) [2]. Ticks were then scored into the four categories: (1) <5ticks; (2) 5-20 ticks; (3) 20-50 ticks; (4) >50 ticks (Ponnudurai *et al.*, 2017) [15]. Collected ticks were stored in 70% ethanol for further processing and identification was done with the help of morphological characteristics as described by Soulsby, (1982) [18].

Result and Discussion

In the present study, a total of 1006 blood samples of animals (754 of cattle and 252 of buffaloes) showing clinical signs like fever, anorexia, pale mucous membrane, lacrymation, nasal discharge, swell lymph nodes etc. were examined from two different regions of Uttarakhand. The overall prevalence of theileriosis in large ruminants of Uttarakhand is shown in Figure 1. Out of 1006 blood samples of cattle and buffaloes screened, a total of 209 (20.77%) blood samples were found positive for theileriosis. Out of the positive samples 182(24.13%) were of cattle and 27 (10.71%) of buffaloes. The positive animals showed mild to moderate infection of theileriosis. The present study was in the agreement with the findings of Arun *et al.* (2014) [3] who reported higher prevalence of theileriosis in cattle (11.98%) rather than buffaloes (8.90%) from different districts of Uttarakhand. The

high prevalence of theileriosis in cattle may be due to thinner skin and dry habitat of cattle which makes them more prone for tick infestation. Tick infestation higher in cattle than buffalo may be due to the dense hair coat on cattle and besides wallowing nature of buffalo causes dropping of ticks resulting in lower infestation rate (Khan, 1986) [6].

Host-wise seasonal prevalence of theileriosis in large ruminants was found maximum in summer season (35.14% and 13.33%) followed by rainy (18.27% and 9.75%) and then winter (3.88% and 5.71%) in cattle and buffaloes respectively as shown in Table 1. The findings are in agreement with Nagar, (2018) [12] and Khaton *et al.* (2021) [7] who found highest prevalence of theileriosis in cattle (63.73% in Uttarakhand and 45% in Rajasthan respectively) in summer season.

Sex-wise prevalence of theileriosis infection in large ruminants of Uttarakhand was found higher in females than males in both host species. The overall prevalence was found to be 26.76% and 11.53% in female and male cattle respectively. On the other hand, female and male buffaloes were found 11.62% and 5.40% positive for *Theileria* sp. infection. The findings of the study are in agreement with Velusamy *et al.* (2014) [21] who reported that there is decrease in immunity in high milk yielding stage along with genetic makeup and seasonal stress in summer months as the reason for high susceptibility to haemoprotozoan infections in cattle. Overall age-wise prevalence of theileriosis in cattle and buffaloes of Uttarakhand was found maximum in the animals above 3 years (25.62%) followed by those between 1-3 years (22.14%) and minimum in the animals belonging to age group less than 1 year (8.38%) as shown in Table-1. Naik *et al.* (2016) [13] also reported highest prevalence in cattle of above 3 years of age (24.34%) followed by 1-3 years and <1 year of age as 23.80% and 14.28%, respectively. Durrani, 2003 [4] reported that the physiological factors like pregnancy, lactation and oestrus leads to the temporary suppression in the immunity of aged animals which causes more chances of getting infection. Morzaria *et al.* (1988) [14] recorded that there is the presence of antibodies against schizonts, sporozoites and piroplasms of *Theileria* sp. in the colostrum of immune cows and in the serum of their calves, which causes low infection of theileriosis in calves. Utech and Wharton (1982) [20] reported that young calves were more resistant to theileriosis than older cows.

The breed-wise prevalence of theileriosis infection in clinical cases of cattle and buffalo of Uttarakhand region by blood smear examination is shown in Table-1. In this study, breeds were categorized as indigenous and cross bred in cattle and upgraded Murrah in buffalo. Out of total 168 indigenous and 586 cross bred of cattle, 13.69% and 27.13%, respectively were found positive for theileriosis infection. On the other hand upgraded Murrah buffalo showed 10.71% prevalence. Khaton *et al.*, 2021 [7] also reported more prevalence of theileriosis in cross bred than indigenous cattle.

On clinical examination of positive animals, it was found that 64(30.62%) of them were infested by ticks mainly on dewlap, inner thighs, udder, ear, inter-digital space and peri-anal region of body. On the other hand, 145(69.37%) of the positive animal population either had a history of heavy tick infestation one to two weeks ago (Table 2). Due to prior treatment of acaricidal, no ticks were present on them. During the study period, female ticks were found more prevalent than males, larvae and nymphs. *Rhipicephalus microplus* was the only tick present on the body of animals infected with

theileriosis. Vatsya *et al.*, (2008) [19] also found the *R. microplus* (96.44%) as a predominant species in Uttarakhand state. In the present study, level of tick infestation was found highest in one animal, while maximum number of ticks (>50) were found in 14 (21.87%) positive animals as shown in Table- 3. Abbas *et al.*, 2021 [1] found no significant relation between tick infestation and parasitemia and reported that 60% of the theileriosis positive animal population was infested with ticks while rest animal populations harbored no ticks.

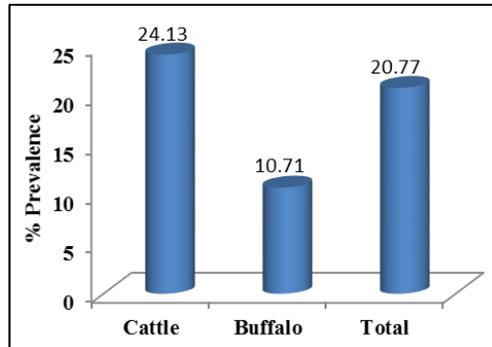


Fig 1: Overall percent prevalence of theileriosis in cattle and buffaloes of Uttarakhand

Table 1: Season, sex, age and breed wise prevalence of theileriosis in cattle and buffaloes of Uttarakhand

Parameters	Cattle	Buffalo	Total	
	NP/NE (%prevalence)	NP/NE (%prevalence)	NP/NE (%prevalence)	
Season	Summer	123/350 (35.14)	18/135 (13.33)	141/485 (29.07)
	Rainy	55/301 (18.27)	8/82 (9.75)	63/383 (16.44)
	Winter	4/103 (3.88)	2/35 (5.71)	6/138 (4.34)
Sex	Female	167/624 (26.76)	25/215 (11.62)	192/839 (22.88)
	Male	15/130 (11.53)	2/37 (5.40)	17/167 (10.17)
Age	<1 year	12/151 (17.21)	2/56 (3.57)	14/207 (8.38)
	1-3 year	53/208 (22.59)	9/72 (12.51)	62/280 (22.14)
	>3 year	117/395 (27.59)	16/124 (12.90)	133/519 (25.62)
Breed	Indigenous	23/168 (13.69)	-	23/168 (13.69)
	Cross bred	159/586 (27.13)	27/252 (10.71)	186/838 (22.19)

NP: Number of animals positive
NE: Number of animal examined

Table 2: Number of animals infected with theileriosis and ticks

Animal species	Animals infected with theileriosis (%)	Animals infected with ticks & theileriosis (%)	Animals infected with theileriosis but having no ticks (%)
Cattle	182 (87.08)	59 (28.22)	123 (58.85)
Buffalo	27 (12.91)	5 (2.39)	22 (10.52)
Total	209	64 (30.62)	145 (69.37)

Table 3: Showing level of parasitemia along with number of animals infested with ticks (<5; 5-20; 20-50; >50)

Thin blood smear examination report		Whole body tick counts				
Level of parasitaemia	No. of animals positive for theileriosis	<5	5-20	20-50	>50	TA/TP (%prevalence)
		Number of tick infested animals				
+	46	1	17	9	2	29/46 (63.04)
++	137	0	6	8	5	19/137 (13.86)
+++	23	0	5	3	7	15/23 (65.21)
++++	3	0	0	1	0	1/3 (33.33)
Total	209	1	28	21	14	64/209 (30.62)

TA: Number of animals infested with ticks
TP: Number of animals infected with theileriosis

Conclusion of the study

The present study revealed that the infection status of theileriosis in cattle was higher than buffaloes. There is a need of proper management to control this infection by proper management for tick population and prophylactic vaccination of animals by Raksha Vac-T in the flock. There must be prior screening of animals for the presence of infection in a herd so that the carrier animals can be diagnosed timely and removed from the flock. There must be a proper study to find out the vector of this disease since *Rhipicephalus* sp. was the only tick found on the infected animals. In order to reduce the rate of infection of disease, there is a need for further investigation using molecular diagnostic techniques like PCR along with proper control measures should be adopted.

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