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Original papers

Status of tick infections among semi-wild cattle in Arunachal Pradesh, India

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ABSTRACT. To explore the seasonal prevalence of tick infections in mithun (*Bos frontalis*) and yak (*B. grunniens*) a study was conducted in Papum Pare district, Kurung-Kumey district and West Kameng district of Arunachal Pradesh, India from December 2012 to November 2014. Adult ticks were collected from both the animals during the month of December 2012 to November 2014. Ectoparasites were identified on the basis of their morpho-anatomical features observed through light microscope. A total of nine different species of ectoparasites recovered belong to the family Ixodidae are *Rhipicephalus (B.) microplus*, *R. (B.) geigy*, *Haemaphysalis davisi*, *H. darjeeling*, *H. longicornis*, *H. bispinosa*, *Ixodes acutitarsus*, *I. ricinus* and *Rhipicephalus sanguineus*. Out of 129 mithun examined during the survey *R. (B.) microplus* and *H. davisi* showed 100% prevalence of infections throughout the year followed by *H. longicornis* (35.65%), *H. bispinosa* (30.23%), *R. (B.) geigy* (25.58%), *I. acutitarsus* (20.93%), *H. darjeeling* (7.75%), *I. ricinus* (1.55%) and *Rhipicephalus sanguineus* (0.77%). Similarly, all 21 yak examined revealed to be infected with *R. (B.) microplus* (100%) followed by *I. acutitarsus* (51.14%) and *H. davisi* (33.33%). In mithun the rate of infection due to all the nine ectoparasites rose to a peak during June to August. Except for the winter season, *R. (B.) geigy* occurred throughout the year. *I. acutitarsus* and *H. darjeeling* showed their occurrence throughout the year except during spring, however, *I. ricinus* and *R. sanguineus* occurs only during rainy season.

Key words: *Bos frontalis*, *B. grunniens*, ecto-parasite, Arunachal Pradesh, India

Introduction

Among livestock, the semi-wild cattle, mithun (*Bos frontalis*) and yak (*B. grunniens*) are most remarkable animals that are found in high hill area of Northeast India. Both the cattle are ranked as vulnerable in IUCN, yet people in Northeast India slaughtered them regularly for food during religious and social ceremonies [1]. Adverse factors like diseases, environmental stress, poor nutrition and management practices etc., are responsible for further decline the production of these animals [2]. These animals have always been prone to different types of diseases caused by virus, bacteria, protozoa, helminths and arthropods. Infections due to arthropods are the major cause of concern for low productivity of livestock animals in tropical and subtropical countries including India [3]. Parasitic arthropods belongs to the subclass Acarina (ticks and mites) are responsible for transmission of several bacterial and protozoan infections among wild and domesticated cattle [4]. It has been reported that almost 80% of the world cattle populations are infected with ticks and tick borne diseases [5]. De Castro [6] estimated that the global costs of ticks and tick borne diseases in cattle is between US$ 13.9 and US$ 18.7 billion per year. It is also known that tick and tick borne diseases are the main health and management problems in livestock animals which affect the livelihood of farming communities specially in Africa, Asia and Latin America [7,8]. Livestock is an important source of animal protein for farm families and is also used for draught power in agriculture and transport, and their dung is used to increase soil fertility. Although India is ranking first in the total milk production in the globe, the livestock sector suffers from a number of diseases, among them the damage caused by tick and tick borne diseases is revealed to be very high [9]. Control of tick and

tick-borne diseases in livestock of India cost US$ 498.7 million per year [8]. Several insecticides are available for effective control of parasitic arthropods, however, due to high cost and non-availability of appropriate insecticides, chemotherapeutic control of the infection may not be viable in this hilly region of the country. Therefore, to formulate suitable strategy concerning appropriate control measures, the seasonal transmission pattern of these parasitic arthropods in the cold desert area must be determined.

Materials and Methods

The study area situated in the north-eastern part of India, lies approximately 750 m (Itanagar, Papum Pare district), 2,217 m (Bomdila, West Kameng district) and 131 m (Nyapin, Kurung-Kumey district) above sea level, respectively and experiences a subtropical to temperate climate. The latitudes and longitudes of the study area are 27.1500° N, 93.7200° E (Papum Pare district), 27.9000° N, 93.3500° E (Kurung-Kumey district) and 27.2500° N, 92.4000° E (West Kameng district), respectively. There are four seasons in the area namely winter (December to February), spring (March to May), rainy (June to August) and autumn (September to November). The number of mithun and yak in the study area are recorded to be 2, 18, 931 and 8, 480, respectively [10]. Both the indigenous animals are raised by local people under the free-ranged system.

Samples were collected during all the four seasons from December 2012 to November 2014. Different ectoparasites were collected from the skin of mithun (*Bos frontalis*) and yak (*B. grunniens*) from Itanagar (Papum Pare district), Bomdila, Dirang (West Kameng District) and Nyapin (Kurung-Kumei district) of Arunachal Pradesh, Northeast India. The external parasites were carefully removed with thumb forceps so that the mouth parts were not left behind during traction from the host animals. Soon after collection, the specimens were immersed in glass vials having 70% ethanol and brought to the laboratory for identification. Alcohol fixed parasites were poured into a big petri dish and with stereomicroscopic observation the specimens were identified following

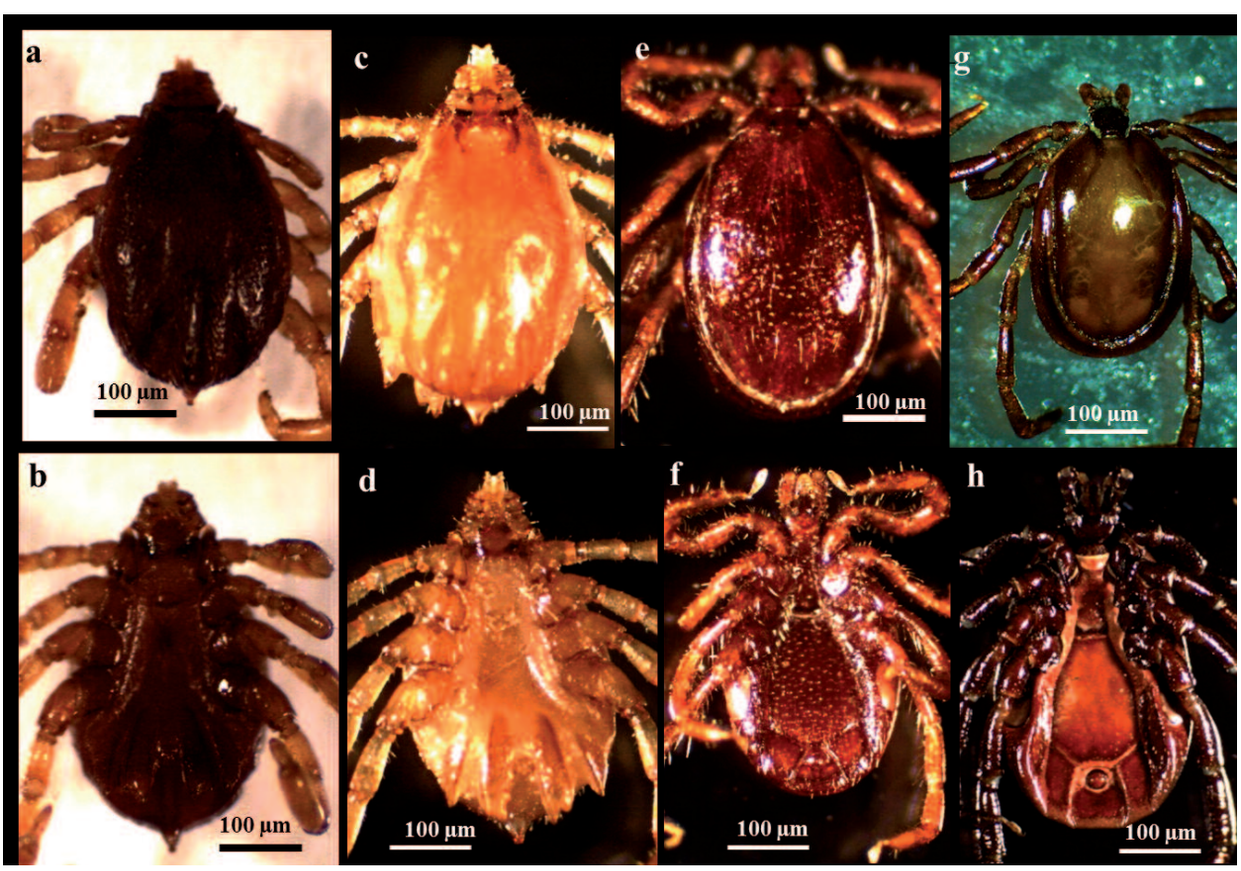

Fig. 1. Light microscopic images of different male parasitic arthropods showing dorsal (a, c, e and g) and ventral (b, d, f and h) surface of the body: (a and b) *R. (B.) microplus*; (c and d) *R. (B.) geigy*; (e and f) *Ixodes ricinus* and (g and h) *I. acutitarsus*

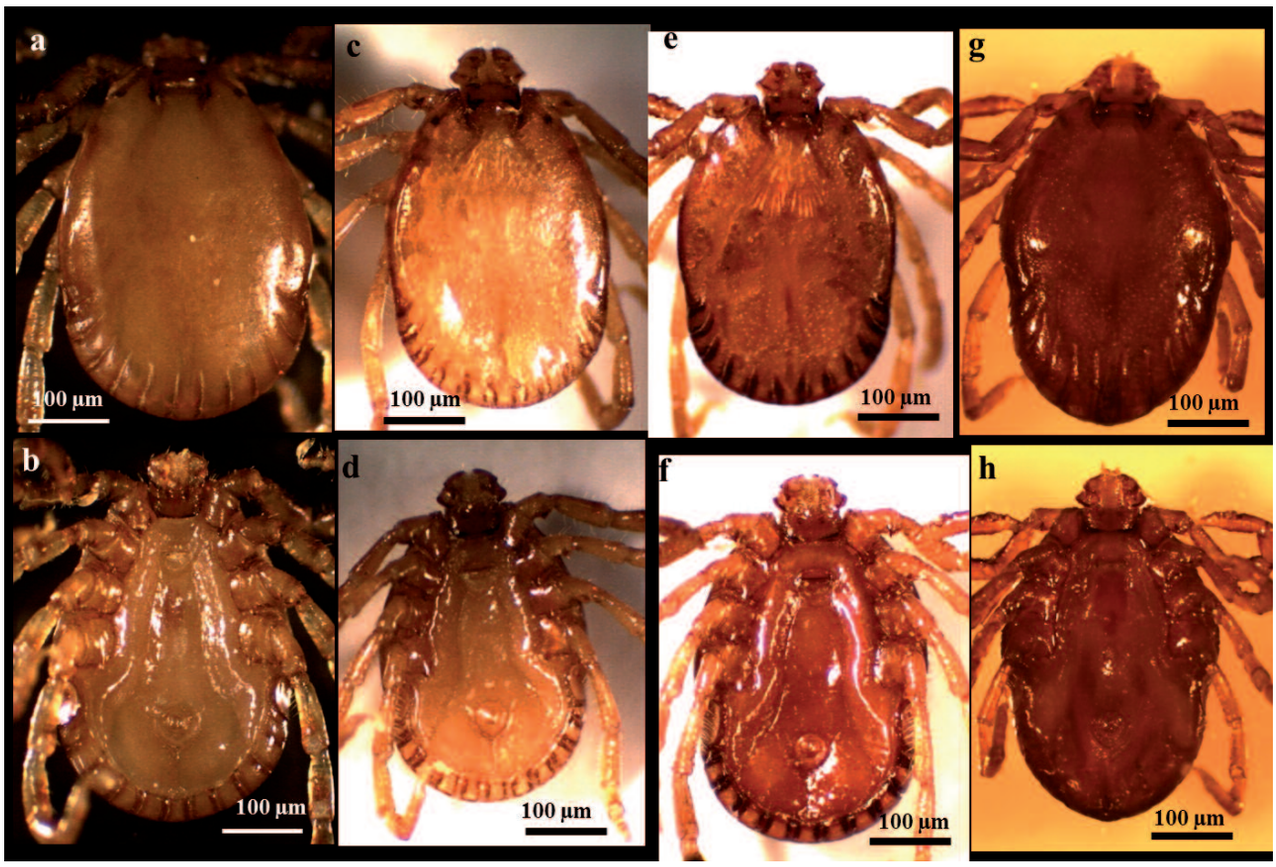

Fig. 2. Light microscopic images showing the dorsal (a, c, e and g) and ventral (b, d, f and h) surface of the male ectoparasites: (a and b) *H. darjeeling*; (c and d) *H. davisi*; (e and f) *H. bispinosa* and (g and h) *H. longicornis*

to the standard identification keys [11,12]. Alcohol fixed tick specimens were washed with distilled water, viewed and photographed under light microscope. The prevalence of infections were determined following Margolis et al. [13].

Results

A total of nine different species of ectoparasites recovered belong to the family Ixodidae, order Ixodida are *R (B.) microplus*, *R. (B.) geigy*, *Haemaphysalis davisi*, *H. darjeeling*, *H. longicornis*, *H. bispinosa*, *Ixodes acutitarsus*, *I. ricinus* and *Rhipicephalus sanguineus* (Figs. 1–3).

All the 129 mithun examined, revealed to be positive (100%) for *R. (B.) microplus* and *H. davisi* infections (Fig. 4). However, *H. longicornis*, *H. bispinosa*, *I. acutitarsus*, *H. darjeeling* and *I. ricinus* showed 35.65%, 30.23%, 20.93%, 7.25% and 1.55% infections, respectively. Unlike *R. (B.) microplus*, *R. (B.) geigy* showed 25.58% positive rate of infections whereas, *Rhipicephalus sanguineus* showed only 0.77 % infections during the period of study. In case of yak out of 21 samples

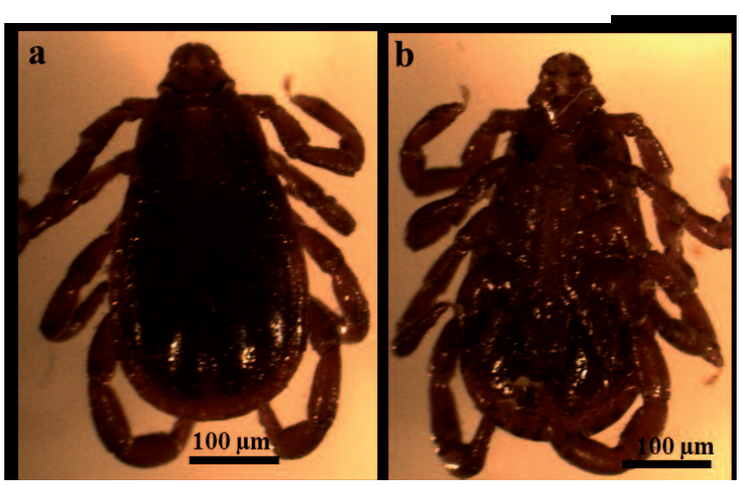

Fig. 3. Light microscopic images of *Rhipicephalus sanguineus* showing dorsal (a) and ventral (b) surface of the body

examined cent percent animals were revealed to be infected with *R. (B.) microplus* followed by *I. acutitarsus* (57.14%) and *H. davisi* (33.33%) (Fig. 4).

In mithun *R. (B.) microplus* and *H. davisi* were recorded throughout the year (Table 1). Both the parasites do not show any seasonal variation in their

Table 1. Season wise prevalence of ectoparasites of mithun (*Bos frontalis*) in Arunachal Pradesh, India

Parasites name	Winter			Spring			Rainy			Autumn			Total No. of host examined	Total No. of host infected	(%) of infection
	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection			
Rhipicephalus (*B.*) *microplus*	34	34	100.00	31	31	100.00	36	36	100.00	28	28	100.00	129	129	100.00
R. (*B.*) *geigyi*	34	0	0	31	7	22.58	36	22	61.11	28	4	14.28	129	33	25.58
Haemaphysalis davisi	34	34	100.00	31	31	100.00	36	36	100.00	28	28	100.00	129	129	100.00
H. longicornis	34	7	20.58	31	12	38.70	36	18	50.00	28	9	32.14	129	46	35.65
H. darjeeling	34	2	5.88	31	0	0	36	7	19.44	28	1	3.57	129	10	7.75
H. bispinosa	34	8	23.52	31	10	32.25	36	15	41.66	28	6	21.42	129	39	30.23
Ixodes acutitarsus	34	6	17.64	31	0	0	36	13	36.11	28	8	28.57	129	27	20.93
I. ricinus	34	0	0	31	0	0	36	2	5.55	28	0	0	129	2	1.55
Rhipicephalus sanguineus	34	0	0	31	0	0	36	1	2.77	28	0	0	129	1	0.77

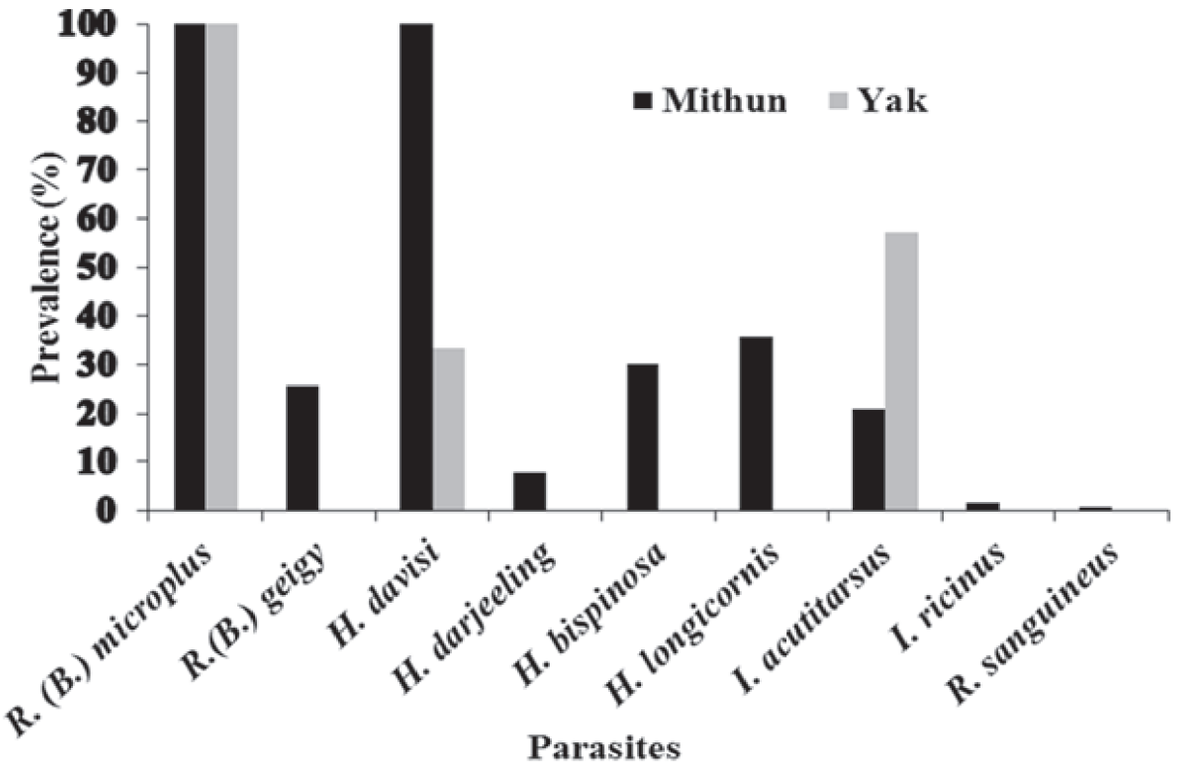

Fig. 4. Graph showing prevalence of different ectoparasites in mithun and yak of Arunachal Pradesh, India

occurrence. *H. longicornis* and *H. bispinosa* though occur all-round the year, a peak period of occurrence during rainy season for both the species was recorded. *H. longicornis* showed lowest rate of prevalence during winter and *H. bispinosa* during autumn was observed. A marked seasonal fluctuations in the occurrence of *R. (B.) geigy*, *H. darjeeling*, *I.acutitasus*, *I. ricinus* and *R. sanguineus* was observed with a peak period of prevalence during rainy season from June to August (Table 1). *H. darjeeling* and *I. acutitarsus* showed a more or less similar trend of occurrence during different season and during spring (March to May) there was no infection. *I. ricinus* and *R. sanguineus* occur only during the month of June to August and the animals do not show any infection during rest of the year (Table 1).

In yak only *R. (B.) microplus* was recorded throughout the year and the parasite does not show any seasonal variation in their occurrence. *I. acutitarsus* and *H. davisi* though occur all around the year; pick periods of occurrence during rainy season for both the species were recorded (Table 2).

Discussion

In the present study most prevalent (100%) parasites of mithun revealed to be *R. (B.) microplus* and *H. davisi* followed by *H. longicornis*, *H. bispinosa*, *I. acutitarsus*, *R. geigy*, *H. darjeeling*, *I. ricinus* and *R. sanguineus*. Similarly, *R. (B.) microplus* also found to be most prevalent in yak too, followed by *I. acutitarsus* and *H. davisi*. However, *R. (B.) geigy*, *H. darjeeling*, *H. longicornis*, *H. bispinosa*, *I. ricinus* and *R. sanguineus* were not recorded from yak in the present study.

Of the nine different species of ectoparasites recorded in the present study *I. ricinus*, *R. (B.) geigy*, *H. darjeeling* and *H. longicornis* are the first record from mithun. Likewise *R. (B.) microplus* and *H. davisi* recovered from yak are the first record from the host in Arunachal Pradesh Northeast, India.

It has been reported that approximately 106 tick species belonging to the families Ixodidae and Argasidae are reported to infest domestic and wild animals in India [14]. Among the reported species of ticks, *Amblyomma testudinarium*, *Dermacentor auratus*, *Haemaphyasalis bispinosa, H. spinigera*, *H. intermedia*, *Hyalomma annatolicum annatolicum*, *H. marginatum isaaci*, *H. hussaini*, *H. detritum*, *H. kumari*, *R. (B.) microplus*, *Ixodes acutitarsus*, *I. ovatus*, *Nosomma monstrosum*, *Rhipicephalus haemaphysaloides* and *R. turanicus* have been considered the most widely distributed tick species infesting cattle, buffalo, sheep and goat in

Table 2. Season wise prevalence of ectoparasites of yak (*Bos grunniens*) in Arunachal Pradesh, India

Parasites name	Winter			Spring			Rainy			Autumn			Total No. of host examined	Total No. of host infected	(%) of infection
	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection	No. of host examined	No. of host infected	(%) of infection			
Rhipicephalus (*B.*) *microplus*	6	6	100.00	4	4	100.00	7	7	100.00	4	4	100.00	21	21	100.00
Haemaphysalis davisi	6	1	16.66	4	1	25	7	4	57.14	4	1	25	21	7	33.33
Ixodes acutitarsus	6	4	66.66	4	1	25	7	5	71.42	4	2	50	21	12	57.14

India [15]. Though the ticks *H. a. anatolicum*, *H. m. isaaci*, *R. (B.) microplus* and *R. haemaphysaloides* are most prevalent species among domestic cattle in all most all the states of India [15], two species of Ixodes ticks (*I. acutitarsus* and *I. ovatus*) were reported from yak and one each namely *R. (B.) microplus* and *H. davisi* were reported from mithun. Recently, Ronghang and Roy [16] recorded the occurrence of *R. sanguineus* and *I. acutitarsus* from mithun in the study area and highlighted their negative impact in public health and livestock industry. Likewise, Saravanan et al. [17] reported the prevalence of *I. cookie* among yak and its hybrids in Northeast India. Zoonotic importance of tick borne diseases was restricted to Europe and America, however, occurrence of babesiosis among human subject as reported by Marathe et al. [18] is a cause of concern for public health in India too. Tick not only act as irritant due to their attachment to animal hides, but also release toxin and pathogens to the blood of their hosts. Prevalence of tick-borne theileriosis among cattle in Northern India revealed to be as high as 13.3 % during summer and only 2.94 % during winter [19]. A similar type of high prevalence (14.4 %) tick-borne diseases (theileriosis, anaplasmoisis and babesiosis) among cattle also recorded during summer in South India [20]. Except *R. (B.) microplus* and *H. davisi* most of the ticks of mithun showed seasonal fluctuations in the prevalence with a peak period of occurrence during rainy season i.e., June to August. Likewise in yak except *R. (B.) microplus*, both *H. davisi* and *I. acutitarsus* revealed their high rate of prevalence during rainy season. Thus there seems to be a direct co-relation exist between high prevalence of vector tick and tick-borne diseases in India. The availability of limited data on epidemiology of ticks and the tick borne diseases among mithun and yak makes it difficult to estimate the extent of economic losses incurred in the study area. For effective management of these vulnerable mammals, dissemination of information among farmers regarding dose and time of application of suitable acaricides and use of specific vaccines to control tick and tick borne diseases should be carried out in this hilly terrain region of India.

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