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Epidemiology of *Rhipicephalus microplus* Ticks in cattle Population of Mathura, Uttar Pradesh

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ABSTRACT

The study was carried out from January 2020 to December 2020. The prevalence of tick infestation was conducted in relation to sex, breed, age and seasonal changes in a year. Cattle of selected places were examined carefully for the presence of ticks and in positive cases ticks were collected manually and identified on the basis of morphological characters. To study the epidemiology of *Rhipicephalus microplus* tick infestation on cattle population of Mathura, a total of 1005 cattle were examined. The overall prevalence of ticks among cattle was recorded 61.89%. Age wise maximum prevalence was reported in animals of less than 1 year age group (75%). Prevalence among female animals (66.80%) was found higher as compared to male (49.10%). Breed wise prevalence revealed, cross bred (83.10%) animals were more susceptible than indigenous breed of cattle (53.03%). Season wise highest and lowest prevalence was reported in monsoon season (80.15%) and winter season (38.95%) respectively.

Keywords *Rhipicephalus microplus* tick, Prevalence, Cattle, Mathura.

INTRODUCTION

India is primarily an agricultural country with about 70% of its population dependent on income from agriculture and livestock industry. India has the world's largest livestock population accounting for over 37.28% of cattle, 21.23% of buffalo, 26.40 of goats and 12.17% of sheep (Sonavale *et al.* 2020).

Ticks are highly specialized obligate haematophagous ectoparasites of mammals, birds and reptiles, distributed worldwide (Furman and Loomis 1984). The damage caused by ticks and tick borne diseases (TTBDs) to livestock is considered very high (Ghosh *et al.* 2007). Ticks generate economic losses to the owners in terms of reduction in milk production and weight loss in animals (Peter *et al*. 2005). Indirectly ticks can be act as carrier of parasitic and rickettsial diseases, which they transmit from host to host during blood sucking thus causing a large variety of diseases (FAO 1998). The major diseases transmitted by tick included babesiosis, theileriosis, anaplasmosis and heart-water disease. In addition,

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indirect losses correspond to the cost of treatment for clinical cases, expenses take place in the control of ticks and inefficiencies in the production system further intensify the economic losses to the livestock industry (Drummond 1983).

Due to severity of the disease transmitted by ticks and other harms caused by them, a large amount of the annual input costs by many livestock owners go into the management and control of these parasites. The global loss due to TTBDs was estimated to be up to 21.38–28.76 billion US$ annually (Narladkar 2018). In India, cost of controlling TTBDs has been estimated as US$ 0.5 billion/annum (Minjauw and McLeod 2003). For dairy sector *Rhipicephalus microplus* (Fig. 1.) considered as the most important tick species. This tick species is known to cause huge losses to the animal owners by transmitting diseases like babesiosis and anaplasmosis. Mathura is well known for its cattle population. Moreover, the general epizootiological factors make it a favorable place for various parasitic diseases. The epidemiological factors like high temperature, humidity, moderate rainfall, plenty water sources magnify the surplus tick population. Therefore, the present study was undertaken to know the prevalence of ticks in relation to the age, sex, breed and different seasons of the year.

MATERIALS AND METHODS

Study area

The present research work was conducted at Department of Parasitology, College of Veterinary Sciences and Animal Husbandry, DUVASU, Mathura, India. All the cattle in the selected places were maintained under semi-intensive system. Morphological study for the identification of the ticks was conducted in the laboratory of the Department of Veterinary Parasitology. The investigation was carried out for a continuous period of one year i.e., from January 2020 to December 2020.

Selection of animals and sampling

For epidemiological studies animals were grouped in three groups viz., adult animals of more than three years, animals of one to three years of age and calves of less than one year. Groups for epidemiological studies were made on the basis of breed of animals viz., cross-bred and indigenous and on the basis of seasons of the year i.e. Summer, Monsoon, Autumn and Winter respectively. Ticks were collected from the different parts of the body from individual cattle by hand picking without damaging their mouth parts. Adequate precautions were taken to preserve the mouth parts and appendages of the ticks during collection.

For epidemiological study of *Rhipicephalus microplus* tick (Fig. 1) infestation a total of 1005 cattle were examined. In the laboratory, ticks were processed as per the standard procedure and keys available for morphological confirmation up to generic level (Sen and Fletcher 1962, Walker 2003). For this length of mouth parts, shape of basis capitulum, legs, festoons, adanal plate, accessory adanal plate, caudal process and other external body parts were

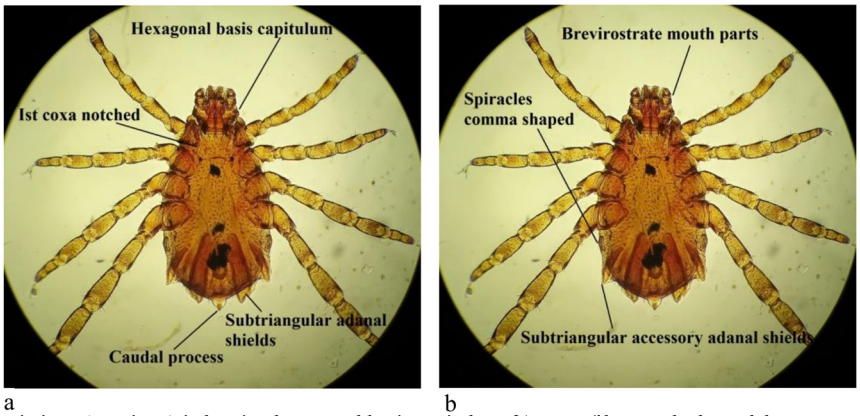

Fig. 1. a. *Rhipicephalus microplus tick* showing hexagonal basis capitulum, I[st] coxa of leg notched, caudal process at posterior end of male tick, subtriangular adanal shields. **b.** *Rhipicephalus microplus* tick showing brevirostrate mouth parts, spiracles comma shaped, subtriangular accessory adanal shields.

taken into account.

The differences in the prevalence of ticks between sex, age groups, breeds and seasons were examined for significance by Chi square test.

RESULTS AND DISCUSSION

For prevalence study of ticks a total of 1005 cattle were examined. Overall prevalence of ticks among cattle was found 61.89 %. The nearly equal level of high prevalence of tick infestation was reported in different villages of the study. In the present study the level of tick infestation was found in the range of 57.95% to 65.61% in different villages of Mathura. No significance difference was observed in between the level of tick infestation in villages and all areas were found equally infested with large number of ticks. This high level of infestation might be due to lacking of tick control measures implemented at village level. Also regular acaricidal treatment was not found followed in the studied areas. The equal level of tick infestation was observed in all the villages indicate similar management practices followed by the animal owners at village level. The nearly equal level of high prevalence was also reported where authors found 58.60% cattle were infested with ticks in different villages of Kerala state (Prakashan and Ramani 2007). (Lakhar 1994) reported 60.64% tick infestation in cattle of Assam. Likewise, (Rahbari *et al*. 2007) recorded 62% tick infestation in cattle in Iran.

Higher infestation of ticks was recorded in females (66.80%) as compared to male animals (49.10%). Among the cattle population examined a significantly higher ($p<0.01$) infestation rates of ticks were observed in females as compared to male animals (Table 1). This might be due to high level of prolactin and progesterone hormone secretion in female animals making the individual more prone to infections. These hormones are known to modulate the immune system of animals and make the animals susceptible to various infections including tick infestation. Moreover, female cattle bear higher stress than males due to pregnancy, lactation and production which make them more susceptible to tick infestation (Mamun *et al.* 2010, Kaur *et al*. 2015). Similar findings were reported where female cattle were more susceptible (58%) to tick infestations as compared to male cattle (36%) from Bangladesh (Mamun *et al.* 2010). Significantly higher prevalence rate of tick infestation was reported in female cattle (33.47%) than in male (14.28%) cattle population of Bangladesh (Bilkis *et al.* 2011).

Highest infestation of ticks was recorded in less than 1 year age animals (75%) followed by animals of 1-3 year age group (65.39%) and lowest in animals of more than 3 year age group (52.90%). Among the cattle population examined a significantly higher ($p<0.01$) infestation rates of ticks were observed in less than 1 year age group animals as compared to adult animals (Table 2). Low tick infestation on adults is probably due to resistance acquired following

Table 1. Sex wise prevalence of *Rhipicephalus microplus* ticks.

Sex of animals	Total no. of cattle examined	No. of cattle infested with ticks	Prevalence (%)
Male	279	137	49.10
Female	726	485	66.80
Total	1005	622	61.89
X^2 (p value)	-	26.77**	-

Table 2. Age wise prevalence of *Rhipicephalus microplus* ticks.

Age of animals	Total no. of cattle examined	No. of cattle infested with ticks	Prevalence (%)
<1 year	260	195	75.00
1-3 year	263	172	65.39
>3 year	482	255	52.90
Total	1005	622	61.89
X^2 (p value)	-	36.79**	-

Table 3. Breed wise prevalence of *Rhipicephalus microplus* ticks.

Breed of animals	Total no. of cattle examined	No. of cattle infested with ticks	Prevalence (%)
Indigenous	709	376	53.03
Crossbred	296	246	83.10
Total	1005	622	61.89
X^2 (p value)	-	80.08**	-

Table 4.: Season wise prevalence of *Rhipicephalus microplus* ticks.

Season	Total no. of cattle examined	No. of cattle infested with ticks	Prevalence (%)
Winter (December-February)	249	97	38.95
Summer (March-June)	251	158	62.94
Monsoon (July- September)	257	206	80.15
Autumn (October-November)	248	161	64.91
Total	1005	622	61.89
X^2 (p value)	-	92.91*	-

repeated infestations from very early life (Mishra 1984, Das1994b). Similar findings were reported in Pantnagar (Vatsya *et al.* 2007) where cattle calves were found more infested with ticks as compared to adults. Similar trend of higher infestation with ticks in younger animals was recorded as compared to adult animals from Pakistan (Manan and Khan 2007).

Higher infestation of ticks was recorded in crossbred cattle (83.10%) as compared to indigenous cattle (53.03%). Among the cattle population examined a significantly higher ($p<0.01$) infestation rates of ticks were observed in crossbred cattle than indigenous cattle (Table 3). A high level of infestation is supposed to due to thin hide in exotic animals as compared to much thicker hide in indigenous cattle. Another factor that saves the indigenous animals from tick infestation is their innate immunity to these parasites. Different previous studies suggest that *Bos indicus* breeds are having inbuilt immunity against the tick bite as compared to *Bos taurus.* Similar trend of higher infestation was recorded in crossbred 88.61% as compared to indigenous cattle 49.75% (Sajid *et al.* 2009, Atif *et al.* 2012 and Kakati 2013).

Highest infestation of ticks was recorded in monsoon season (80.15%) followed by autumn season (64.91%), summer season (62.94%) and lowest in winter season (38.95%). Among the cattle population examined a significantly ($p<0.05$) infestation rates of ticks were observed in monsoon season as compared to other seasons (Table 4). This might be due to hot and humid environment conditions in monsoon season that are favorable for the development of various stages of ticks. Similar observations on seasonal prevalence have been reported from Pantnagar with a maximum infestation rate (59.28%) in rainy season and minimum (22.78%) in winter season was reported by Das (1994a). Animals having tick infestation throughout the year with maximum level during rainy season, moderate during summer and least during winter season (Vatsya *et al.* 2008 and Kumar *et al.* 2014).

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