

Prevalence of naturally occurring theileriosis in cattle of Tripura, India

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Abstract

Tick and tick-borne haemoparasitic diseases cause significant losses to livestock. Among these haemoparasitic infections, *Theileria* species are very common in cattle and cause devastating losses to the livestock industry and pose a major threat to the dairy industry throughout the world. The present study aimed to assess the prevalence of theileriosis in Tripura for a period of one year, from November 2020 to October 2021. Both apparently healthy and clinically suspected cattle of three different age groups (young, young-adult and adult), both indigenous and crossbreeds of both sexes, were randomly selected from four districts of Tripura. A total number of 240 blood samples were screened randomly using Giemsa's staining technique. Microscopic examination of blood smears revealed 18.75% (45) overall prevalence. The female cattle (20%) had a higher prevalence than the male ones (15.38%). Age-wise study revealed that the adult group (19.56%) had a slightly higher infection rate compared to the young group (19.05%) and young adult group (16.66%). The breed-wise study showed a higher infection rate of theileriosis in crossbred cattle (24.14%) as compared with indigenous (10.53%). The highest prevalence rate was found in the monsoon (28.34%) season. The present study indicates further screening at a large scale and to adopt control measures to reduce the extent of infection. Advanced diagnostic techniques need to be employed to determine the carrier state of animals.

Keywords: Cattle, Naturally occurring theileriosis, Prevalence, Tripura

Highlights

- It is the first systematic prevalence study on cattle theileriosis in Tripura.
- Further research work will be helpful in understanding the epidemiological status of theileriosis in cattle in Tripura.
- In this article, we are reporting the prevalence of theileriosis in cattle with breed, age, sex and season wise.
- Our observation will be helpful in adopting curative and prophylactic measures for the control of theileriosis.

INTRODUCTION

Tripura is a developing agriculture-based small hilly state in North Eastern India. The livestock sector contributes to the socio-economic development of this state by providing nutrition and cash income for rural agricultural households. The total livestock

population of Tripura is 13.18 lakh, out of which 56.08% (7.39 lakh) is cattle (ARDD, 2020). The growing demand for dairy products emphasizes the necessity to improve the productivity of the local cattle industry. However, profitable cattle husbandry is limited by several factors in this small state, of which various tick and tick-borne

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haemoparasitic diseases (TBHD) are the major ones (Uilenberg, 1995; Ghosh *et al.*, 2007). Among various TBHDs, bovine theileriosis is one of the most important haemoparasitic diseases that cause significant morbidity and mortality rates in cattle (Ghosh and Nagar, 2014). In India, due to tropical theileriosis alone, the amount of loss is US\$ 800 million per annum (Devendra, 1995). Theileriosis is manifested by pyrexia, lymphoid hyperplasia, digestive disorders and associated pathological changes due to destruction of erythrocytes (Taylor *et al.*, 2016). The animals that recover from acute infection remain as carriers, creating a potential source of infection to healthy susceptible population (Nair *et al.*, 2011). Early diagnosis and implementation of effective treatment as well as control measures are necessary to prevent mortality and associated production losses (Modi *et al.*, 2015). However, no systematic information is available on the prevalence of TBHDs in cattle from Tripura till date. Looking into the problems and losses incurred by dairy farmers due to theileriosis, the present study was aimed for the first time in Tripura to search out the status of theileriosis in cattle and to formulate future planning for controlling the disease.

MATERIALS AND METHODS

Location and period of study: The present study was carried out to gather information on the prevalence of theileriosis in cattle of Tripura, India. For this study, blood samples were collected from cattle of four different districts, viz., West Tripura, Sepahijala, Khowai and Dhalai. In all these selected places, cattle were maintained by semi-intensive system. The investigation was carried out for a continuous period of one year, *i.e.*, from November 2020 to October 2021. All the months were divided into three seasons, viz. winter (November 20 to February 21), summer (March 21 to June 21) and monsoon (July 21 to October 21).

Selection of animals: Both indigenous and crossbred cattle of either sex and within the age

group of 6 months to more than 3 years were considered for the present work. A total of 240 cattle (65 male and 175 female) were selected, and blood samples were collected from the cattle of different districts of Tripura. Out of 240 cattle, 42 were of <1 year (younger age group), 60 were within 1-3 years (young adult), and 138 were >3 years age group (adult). The prevalence of TBHD was recorded on the basis of sex, age, breed and seasonal changes.

Collection of blood samples: A total of 240 blood samples from both apparently healthy and clinically suspected were collected aseptically from individual cattle by ear vein/jugular vein puncture from the selected areas. Blood smears were prepared on the spot whenever possible, and if not, the smears were prepared in the laboratory from collected whole blood preserved in vacutainers containing EDTA.

Staining of blood smears: The blood smears were prepared according to McCosker (1975) by using a small drop of blood. The smears were air dried and fixed in absolute methanol for 2-3 minutes. The slides were labeled, indicating site, animal type and collection date. The smears were stained using Giemsa's stain following standard protocol in the laboratory (Soulsby, 1982). The stained slides were examined under X100 magnification using an oil immersion lens for the presence of *Theileria* sp., individually, according to the keys and description gave by Soulsby (1982). The percent prevalence of theileriosis in this study was calculated using the formula given by Thrusfield (2007).

Statistical analysis: All the data were categorized according to age, sex, breed and season to determine the status of *Theileria* infection in cattle. All the parameters were compared (Analyze - Compare Means) for the mean value along with standard error (SE). Further analysis has been made separately by Duncan method (One way ANOVA), and the significance (P value) was recorded at 5% level

Prevalence of theileriosis in cattle of Tripura

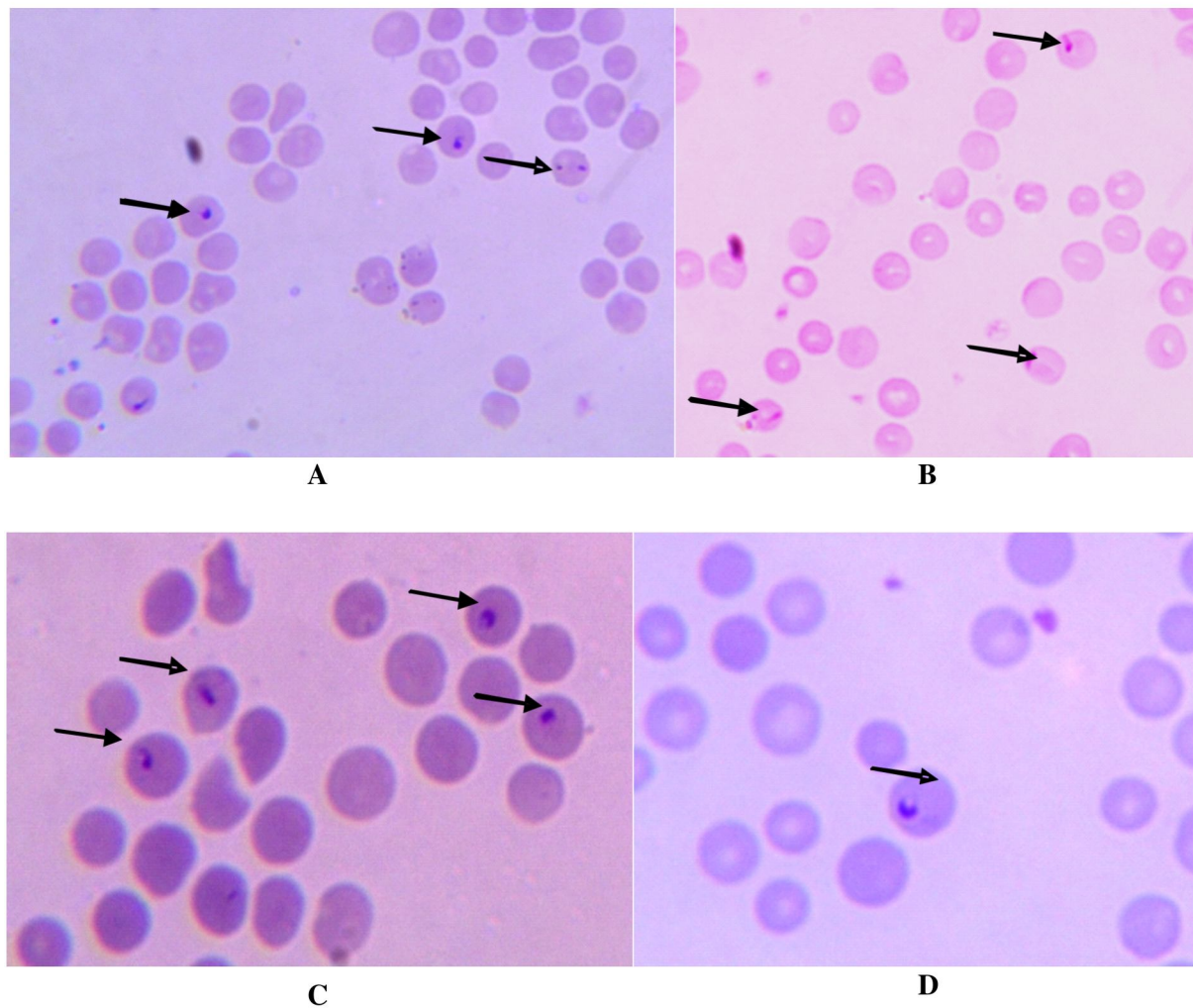


Fig. 1. Giemsa-stained blood film (A-D) of cattle indicates (Arrows) pleomorphic piroplasmic forms (merozoites) of *Theilaria* sp. within the infected erythrocytes

and 1% level. The complete statistical analysis was done with the help of Statistical Package for Social Scientists (SPSS), Windows Version 20.0.

RESULTS

A total of 240 blood smears from cattle were thoroughly screened to detect *Theileria* organisms. Typical piroplasmic stages of *Theileria* sp., appearing as thin or thick rods, comma, dot, club and ring-shaped, were detected. (Fig. 1). Out of the 240 samples, 45 (18.75%) samples were found to be positive for *Theileria* infection.

It was evident from the study that the female (20%) showed significantly ($P<0.01$) higher prevalence rate than the male (15.38%) (Fig. 2).

Theileriosis in cattle varied significantly ($p<0.01$) among the different age groups of cattle selected for the present study. The prevalence of theileriosis was significantly ($p<0.01$) higher in the adult age group of cattle (19.56%) compared to the young (19.05%) and young adult age group (16.66%), respectively (Fig. 2).

On the other hand, breed-wise results

showed that crossbred cattle were found to have significantly ($P<0.01$) higher (24.14%) rate of infection as compared to the indigenous cattle (10.53%) in Tripura (Fig. 2).

A significant level of variation ($P<0.01$) was observed in the overall mean monthly and seasonal distribution of theileriosis in cattle of Tripura. A significantly ($P<0.05$) higher prevalence was recorded in the month of October (35.71%), and the lowest prevalence rate was recorded in the month of November (5.26%), respectively (Fig. 3). Season-wise prevalence study of theileriosis in cattle indicated a significantly ($p<0.01$) highest prevalence rate in monsoon (28.34%) followed by summer (14.45%) and lowest in winter (7.66%), respectively (Fig. 4).

DISCUSSION

In the present study, the overall prevalence of theileriosis was recorded as 18.75% in cattle of Tripura. More or less similar rates of prevalence of *Theileria* spp. in cattle population were reported from various parts of the country by several researchers (Ananda *et al.*, 2009; Nair *et al.*, 2011; Chaudhri *et al.*, 2013; Velusamy *et al.*, 2014; Bhatnagar *et al.*, 2015;

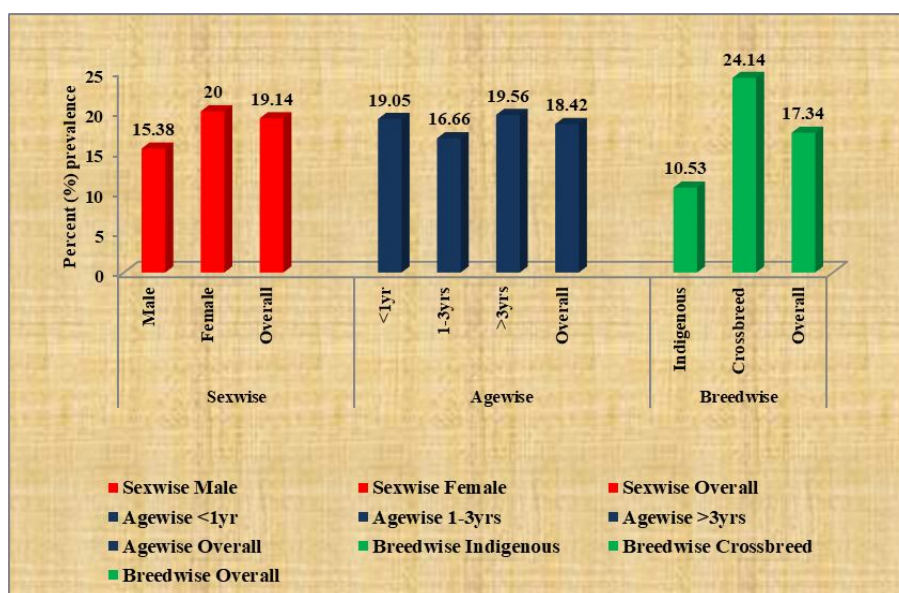


Fig. 2. Overall sex, age and breed-wise prevalence of theileriosis in cattle of Tripura

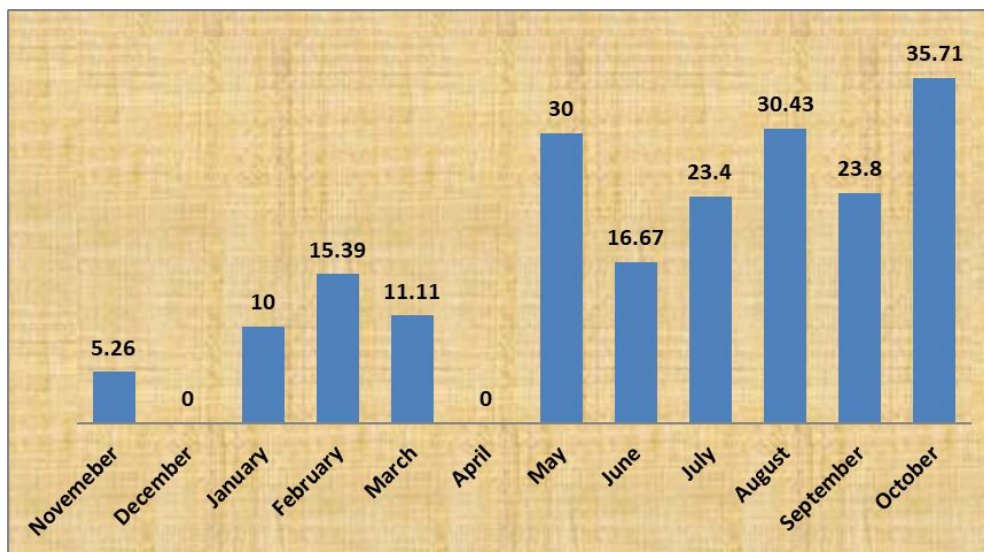


Fig. 3. Overall mean monthly prevalence of theileriosis in cattle of Tripura

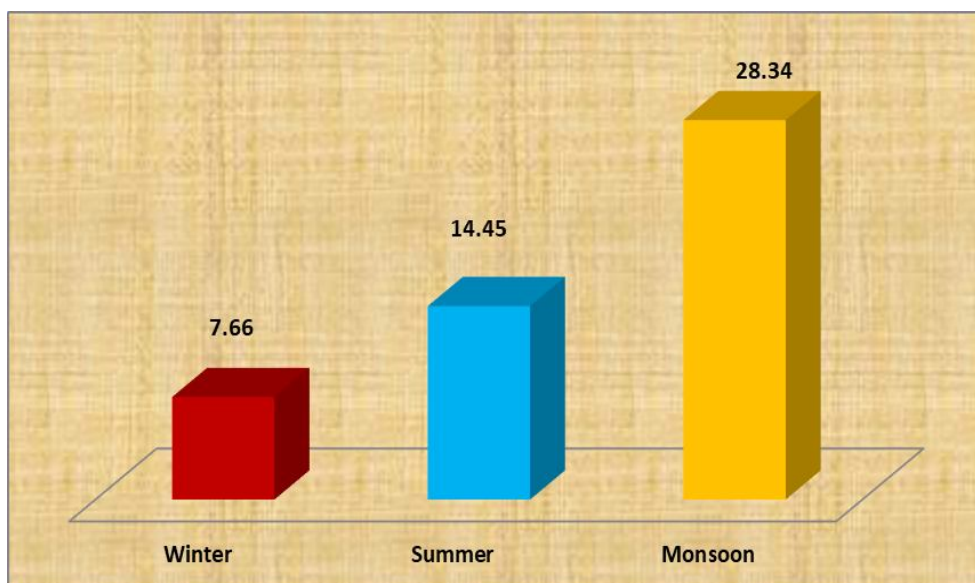


Fig. 4. Seasons-wise prevalence of theileriosis in cattle of Tripura

Kumar *et al.*, 2015; Debbarma *et al.*, 2020). Differences in the results of present and previous findings might be subjected to variations in climatic and geographical conditions of the study area, variations in the animal husbandry practices and methodology adopted for the study.

In the present study, the female population were found to be significantly ($P < 0.01$) more

infected compared to the male. This finding was in accordance with Ananda *et al.* (2009), Debbarma *et al.* (2020) and Patra *et al.* (2021). It might be due to the high levels of prolactin and progesterone hormones that make an individual more prone to any infection (Lloyd, 1983). In explanation, it could be concluded that female cattle bear higher stress than males due to pregnancy, lactation and production,

making them more prone to infection (Mamun *et al.*, 2010).

Among the positive animals, highest prevalence of theileriosis was observed in the adult group (19.56%). Female cattle of this age group were mostly in lactating stage (Debbarma *et al.*, 2020). The weakening of immunity during the high milk-yielding stage, in addition to genetic makeup and seasonal stress in monsoon and summer months could be the reason for high susceptibility to this haemoprotozoan parasite. (Radostits *et al.*, 2000; Velusamy *et al.*, 2014).

Breed-wise prevalence data revealed that crossbred (32.14%) cattle were significantly ($P < 0.01$) highly affected compared to indigenous cattle (18.95%), which was in agreement with the observation made by the other workers viz. Chowdhury *et al.* (2006), Alim *et al.* (2012), Velusamy *et al.* (2014), RATHERA *et al.* (2015), Debbarma *et al.* (2019) and Patra *et al.* (2021). Variation in susceptibility between breeds might be due to the breed resistance (Debbarma *et al.*, 2019). Local breeds have different genetic makeup, which makes them resistant to these parasites and the climatic conditions of this region also may not favour the disease in local animals (RATHERA *et al.*, 2015). Constant exposure to infections and the development of immunity against such infections might be responsible for lower susceptibility in indigenous cattle (Siddiki *et al.*, 2010). Moreover, indigenous cattle are reared with minimal tick control, exploiting their innate and acquired resistance against ticks and TBHDs (Minjauw and McLeod, 2003). On the contrary, more attention to the management of crossbred cattle gives less chance of pre-exposure to vectors and the resulting development of no or less immunity, causing frequent occurrence of such diseases (Ananda *et al.*, 2009; Siddiki *et al.*, 2010, Alim *et al.*, 2012).

There was a considerable seasonal variation in the prevalence of theileriosis. The highest prevalence was found during the monsoon season (28.34%), and the lowest was during the winter season (7.66%). The seasonal prevalence

observed in the present study was in accordance with the findings of Ananda *et al.* (2009), Kohli *et al.* (2014), Bhatnagar *et al.* (2015) and Debbarma *et al.* (2020), who recorded a higher prevalence of theileriosis in monsoon. Peak of tick population is generally observed during monsoon in different parts of India, which might be accounted for higher prevalence of *Theileria* spp. infections in the rainy season during the study. On the other hand, lower temperature and humidity of winter months were less favorable for the growth and multiplication of tick vectors which might be responsible for the lowest frequency of occurrence of theileriosis in the cattle population of the present study (Singh and Rath., 2013; Debbarma *et al.*, 2018).

The result of the current study indicates that the state of Tripura is also endemic for theileriosis in cattle. The result reflects that female crossbred animals above 3 years are more susceptible to theileriosis than indigenous animals. The occurrence of the disease was high during monsoon. The results of the present study indicate a need for further investigations using molecular techniques to accurately identify the carrier status of haemoprotozoan parasites in other parts of the state involving large number of animals population and conducting the program for controlling tick populations.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: All authors equally participated in designing this article, data analysis and interpreting the results, drafting, editing the manuscript and approved the final version of the manuscript.

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