

# Blood protozoan disease theileriosis: causes and prevalence



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The genesis of the problem has been the introduction of the 6 cows from Rajasthan, a hot and dry state of India in the Holstein cross bred herd in the Graphic Era University dairy at Dehradun capital of hill state of India.

Suddenly after introduction of these Sindhi cows there was death of death of 8 cross breed cows in 2010. In spite all possible veterinary treatments.

However we have examined the blood samples of these animals which were found positive for *Theileria* and the same was confirmed by Indian Veterinary Research Institute (IVRI) thus we have reported *Theileria* for the first time from the hilly region of Uttarakhand [39]. The native cows did not suffer of *Theileria* but crosses of Holstein do suffer and die.

Twenty year back in India the cow producing over 1 gallon of milk was considered to be high producing cows. Since 1971, the cross breeding with high producing cows of European and North American horizon has introduced. India's cow population is 200 million out of this population 20 percent is cross bred, say 40 million. These cross bred produce over 15 litres of milk. Hence our milk production has increased but the introduction of cross bred animals has increased the vulnerability of herds to tick borne diseases (TBDs). The most common TBDs in India are tropical theileriosis, babesiosis and anaplasmosis. The most detrimental blood protozoan is *Theileria*. Our native cows have not been susceptible to *Babesia* and *Theileria* [12, 370, 371]. However the cross bred cows has been in danger. *Theileria* are obligate intracellular protozoan parasites that cause theileriosis. The babesia affects only adult animals and occurrence of *Babesia* is marked by red colour urine. So it has been diagnosed easily. The drug for treatment of *Babesia* is cheap and easily available in the market and animal can be

easily saved. The *Theileria* causes very great damage to cross bred cows because it affects all ages of the cattle and it is transmitted in calves from mother. The tick positive with the *Theileria* has to be attached for 48-72 hours which has to be infected.

The *Theileria* protozoan affects the exotic animals but not the native animals. Exotic cattle ( *Bos taurus* ) are particularly susceptible with mortalities up to 40–80% in some areas, whereas indigenous cattle ( *B. indicus* ) generally suffer much lower mortalities (about 10%) confined mainly to calves [57]. This is the same as Negro has not affected by malaria where European has affected by malaria. *Plasmodium falciparum* , has inhibited in glucose six phosphate dehydrogenase (G6PD)-deficient erythrocytes the parasite has very sensitive to oxidative damage and has killed at oxidative stress level that doesn't affects the G6PD-deficient human (Negro) host. By this human population with G6PD-deficient genotype survives in malaria prevalent areas. The same is true about *Theileria* , exotic cow suffers due to *Theileria* but native do not.

The theileriosis has not been fatal in subclinical cases. It lowers production and reproduction this is because the tropical theileriosis resulting from the infection with the intracellular protozoan parasite *Theileria annulata* [379] has considered as a progressive lymphoproliferative disease which imposes heavy losses due to decreased productivity and considerable mortality in cattle [380]. After the invasion of the parasites into lymphoid cells, they invade the erythrocytes to complete part of their life cycle [364], whereby the occurrence of mild to severe anaemia would be inevitable [381]. Some recent studies have declared that the anaemia is probably a consequence of <https://assignbuster.com/blood-protozoan-disease-theileriosis-causes-and-prevalence/>

the oxidative damage in erythrocytes [382, 383] and indicated significant modulations in the activity of antioxidant enzymes such as superoxide dismutase (SOD), glutathione peroxidase (GPX) [384] and catalase [385]. Furthermore, some studies suggested that erythrocytes destruction during oxidative stress has related to membrane lipid peroxidation [385]. This process might cause morphological changes in the cell surface and cellular osmotic fragility, whereby an increase in the erythrocytes susceptibility to phagocytosis would be predictable.

Dairy with Holstein cows has become a big enterprise but theileriosis have extensive prevalence and high mortality rates due to these cause economic losses, as in several countries [386]. We have reported incidence of theileriosis in the hot and humid month this is in agreement with other workers. The highest abundance of the ticks was reported in the month of July [239] whereas *Hyalomma* sp. of ticks is most abundant in June [369].

India is a vast country where tropical and Himalayan regions both present. *Theileria* has reported from many tropical regions of India but there has no report of theileriosis from the hilly states in India. However, we have reported theileriosis from sub Himalayan, sub tropical region. India theileriosis has been reported from Punjab, Haryana, Gujarat etc. geographical regions. In Bangalore north the occurrence of *T. annulata* among crossbred cattle has reported in 2009 [365]. In Northern Kerala 16 % positive cases of theileriosis has reported in crossbred cattle [222]. 37% cattle reported positive for the haemoprotozoan infection in Kaira and Anand District of Gujarat [387]. They have also reported that the higher incidence of *Theileria* has found in monsoon season. A case of tropical theileriosis has <https://assignbuster.com/blood-protozoan-disease-theileriosis-causes-and-prevalence/>

also reported from West Bengal in 2012 [223]. An outbreak of theileriosis in cattle has reported from Punjab with 4. 86% mortality rate [388].

The cross bred animals are most sensitive to heat [389]. They further stated that the climate temperature control the activity of both *Theileria* as well as the vector of this protozoan disease. In indigenous cattle no extra care is needed to control tick infestation. Mortality is usually low or insignificant due to tick-borne diseases in indigenous cattle because they are resistant to ticks responsible for transmission of parasites [390, 391, 392, 393]. The 0% mortality and low incidence of theileriosis in Sahiwal suggests that this breed exhibits a high level of resistance to ticks and ultimately to tick transmitted diseases.

We have found thermal humidity index (THI) for the 2 consecutive years. Surprisingly in this doing so we have found out that the milk production in cows which are low producers (<15 lt) is not affected by THI, however it has very much affected in high milk producing cows (> 15 lt). The cross bred animals are most sensitive to heat [389]. In this connection we have measured the thyroid hormones also which was found very high during winter months and low in summer months.

In our study we included. 40 HF cross bred cows for the period of 10 months i. e. from June to March. The 40 lactating HF cows have assigned to 2 groups according to milk production i. e. high milk producers and low milk producers. As THI increases milk yield decreases. This decrease in the milk production can range from 35-40%. In the high yielding cows once the milk production decline it has not been rise and there has been loss of 8-10 litre

milk everyday and this has irreversible loss. In the low yielding cows producing less than 8 or 10 litre of milk, they has not much affected by increase in thermal humidity index or stress level.

We carried out our study in cross bred cattle in Dehradun district, Uttarakhand during summer, rainy, winter and spring season. Since then we have been diagnosing *Theileria* all around the Dehradun, the capital of Uttarakhand. Microscopically we have examined a total of 301 cattle by using Giemsa's stained blood smear method. Giemsa's-stained blood films contained *Theileria* piroplasms, including cocci, rod, stick, comma, fusiform, racquet-shaped, signet-ring, and pear-shaped forms with diameter of 0.5-1.5 micrometer. The ring form has found to be the most common in present study. Microscopic examination of blood smears have revealed 27.2% (82) overall prevalence of theileriosis. Season wise 9.0% cows have found positive for *Theileria* as per blood smear in spring season, 19.6% have found positive in summer season, 45.4% have found positive in rainy season and 8.8% have found positive in winter season. Highest numbers of positive cases have obtained in rainy season which corresponds to months between July and October when the THI has also found high i. e. above 80. Similar observations have observed in previous reports [365, 366]. High incidences of tropical theileriosis in cross bred cattle were found during summer and monsoon season [367]. The result coincides with the study conducted in Zimbabwe and Rhodesia [30]. They found that peak activity of tick occurred in humid season and the seasonal activity has greatly influenced by temperature, humidity and day length. Similar observations have made by Flach who studied the epidemiology of tropical theileriosis in an endemic

area of Morocco [100]. He reported adult *Hyalomma detritum detritum* peak numbers at the end of June. The activity period of *Hyalomma detritum detritum* was between September and early December and the highest numbers of vector ticks were found in late October. The data collected indicated that *H. detritum detritum* delays either egg laying in summer or larval host searching in autumn.

There is a new biotechnology innovation which has been recently come. This innovation is outcome of recognition of endonuclease by Hamilton smith in 1971 and recombinant technology initiated by Herbert Boyer and Stanley Cohen in 1973 and polymerase chain reaction by Kary Mullis in 1983. The enzyme linked immunoassay for antibody in immunodiagnosis was tool of diagnosis in sick animals. The antibodies are not 100% correct. Because the antibody cross react. Sample size should be large. The DNA does not cross react. Small sample size required. In nut shell the results are quick and reproducible. However it is bit expensive.

Besides 82 positive samples, we found that 16 other samples were also detected as positive for the disease in the polymerase chain reaction test. These cattle were categorized as “ carrier cattle”. So *Theileria* genus specific PCR could detect 98 samples (32. 5 %) as positive. Thus it has confirmed that PCR test is more sensitive in detecting low grade of infections in carrier animals and hence is more suitable for epidemiological surveys as compared with microscopic blood and lymph node smear examination. Similar observations were made that carriers are important contributors to the infection within *Hyalomma* ticks [36]. Detection of carrier animals is very important to control the spread of infection. However, due to low number of <https://assignbuster.com/blood-protozoan-disease-theileriosis-causes-and-prevalence/>

infected erythrocytes in carriers it is difficult to identify them by Giemsa staining of blood smears. The efficacy of PCR was also reported which concluded PCR as a versatile method for the identification of multiple tick-borne infections in cattle [139]. Similar observations were reported by Aktas in their survey to check the prevalence of *Theileria* by PCR conducted in eastern Turkey [162]. They reported that out of 252 blood samples examined, 41 (16%) have positive for piroplasms by microscopy, whereas 114 (45%) have positive for the presence of at least one species of *Theileria* by PCR. The percentages of positive animals for *Theileria annulata* and benign *Theileria* species ( *Theileria sergenti/buffeli/orientalis* ) have 39% (99/252) and 7% (18/252), respectively. The sensitivity and specificity of PCR test has also confirmed [152, 155, 171, 177].

The specificity of the primer set N516/N517 is confirmed by PCR test. Expected band was generated on agarose gel of size 721-bp and it was confirmed by running 100 bp ladder DNA alongwith sample. *Theileria*-specific small subunit rRNA primers 989 and 990 have also used and expected 1098 bp fragment of DNA was amplified. These findings were in accordance to Allsopp who differentiate six species of *Theileria* by PCR test [26]. The expected fragment of size 721- bp has been shown on agarose gel by electrophoresis which corresponds to 19 parasites per ml. These findings were in accordance to Roy who also detected *Theileria annulata* carrier cattle by polymerase chain reaction (PCR).

Some cattle after treatment in early stage of the infection become immune carriers. No schizonts were found in the lymph node of the carrier but few *Theileria* piroplasms still resides in erythrocytes. Therefore, such carrier <https://assignbuster.com/blood-protozoan-disease-theileriosis-causes-and-prevalence/>



animals have been not detected by microscopic examination as well as serological tests. All the infected animals during field and experimental study showed clinical manifestations ranging from mild to severe reactions. The clinical signs included high fever, swelling of submandibular and subscapular lymph nodes, weakness, increased respiration and pulse. Anorexia, anaemia and loss of condition also occurred. The first symptom of fever was manifested by the animal in theileriosis [368]. The clinical signs recorded in the present study were also reported [6]. Similar findings were reported *Theileria annulata* infection in cross bred animals at Faisalabad with clinical signs of enlarged lymph nodes and spleen, oedema of lungs and hemorrhages in the abomasums [12]. Swelling of lymph nodes was the first sign in all calves along with lacrimal and nasal secretions [113]. This study also reported that initially animals were constipated and had mucus covered faeces, this has followed by diarrhoea which resulted in emaciation and weakness. In the last stage of the disease calves showed laboured respiration, recumbancy, depression and all infected animals died.

Today because of the availability of the sexed semen and environmentally controlled housing the dairying has become big enterprise with big profit. However the problem of *Theileria* remains to be solved. The *Theileria* can be diagnosed microscopically in clinical cases. However, the subclinical cases, which has not been apparently sick and cannot be diagnosed microscopically. They need to be diagnosed by the Polymerase Chain Reaction.

Vaccines for this disease are available but that has to be kept in liquid nitrogen and -197 degree Centigrade and whole lot of 300 doses has to be purchased which has been available at around rupees one lakh. .

It has reported recently even in the sub clinical cases if vaccination is done then *Theileria* flares up plus those animals which has vaccinated always found positive microscopically (personal communication with Dr. Rajat Garg of Indian Research Institute).

In this connection we have diagnosed *Theileria* microscopically by which only 50% of the cases were diagnosed. The present study has been focused on blood protozoan disease theileriosis and its prevalence as well as finding out the “ carriers”. This study was carried out for ten months (March to December) and the cases positive for theileriosis showed that there was a high prevalence of these haemoprotozoan, especially in the rainy season, in Dehradun district. This is in agreement with previous research [394, 395]. PCR has allowed the development of sensitive and specific diagnostic assays for *Theileria* [35]. It is also reflected from our study that the entire positively stained samples were confirmed positive by PCR but an additional 16 samples were also detected as positive (“ carriers”). As Dehradun is a hilly region, so it was thought that the occurrence of these haemoprotozoan is very less because of the temperate climate. But our study suggests that this problem is spreading in Dehradun area and also in areas located in middle Himalaya region (especially the valleys in central Himalaya) where farmers have introduced exotic cattle breed as an attempt to increase their dairy yields. So it is suggested that essential screening should be done before introduction of the cross bred cows.

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