

## Influence of season, age and breed on prevalence of haemoprotozoan diseases in cattle of Tamil Nadu, India

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### Abstract

**Aim:** To assess the prevalence of haemoprotozoan diseases in cross-bred and indigenous cattle in relation to season, age and breed in Western part of Tamil Nadu, India.

**Materials and Methods:** A total of 2637 blood smears were screened for haemoprotozoan diseases and samples were received from the college hospital and veterinary dispensaries in Western part of Tamil Nadu, India. Blood smears were stained using Giemsa's technique and examined under oil immersion.

**Results:** Microscopic examination of blood smears revealed an overall prevalence of 16.64 %; of which theileriosis was 13 %, followed by anaplasmosis 2.64 % and then babesiosis 1.0 %. Among the haemoprotozoan diseases, the prevalence of theileriosis was significantly ( $p < 0.05$ ) high during summer (14.4%), followed by moderate in monsoon (13.8%) and less in fair (11.5%) seasons. However, there was no significant seasonal influence on the prevalence of babesiosis and anaplasmosis. The data on influence of breed revealed that there was a significantly ( $p < 0.05$ ) high prevalence of haemoprotozoan diseases in Holstein Friesian (HF) and Jersey cross breeds than indigenous breed and the occurrence of these haemoprotozoan diseases was found to be high among the age groups of 2-7 years in cross-bred animals and below 2 years in indigenous animals.

**Conclusion:** The present study suggests that Western part of Tamil Nadu is highly endemic for theileriosis and occurrence of the disease was high during summer. Cross-bred animals aged 2-7 years are highly susceptible to these haemoprotozoan diseases than indigenous animals.

**Keywords:** anaplasmosis, babesiosis, cattle, prevalence, theileriosis.

### Introduction

Haemoprotozoan infections 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 [1]. Most of the haemoprotozoan parasites are transmitted by ticks and is of great economic importance in Asia and has always been a formidable barrier to the survival of exotic and cross bred cattle in India [2]. The hot and humid climate is very conducive for the development and survival of potential vectors such as ticks and flies and is a constant source of infection to susceptible animals [3]. Theileriosis, babesiosis and anaplasmosis are the three major tick borne haemoprotozoan diseases of cross-bred cattle in tropical and sub-tropical regions of the world [4, 5, 6]. In India, the annual loss estimated due to tropical theileriosis alone is approximately US \$ 800 million [7]. In the absence of adequate control measures, these haemoprotozoan diseases have serious economic impact on cattle production in terms of

mortality, reduced milk yield and lowered draft power.

In India, haemoprotozoan diseases have been reported from different geographical regions. The incidence of theileriosis was found to be 27.2% in cross-bred cattle with highest prevalence rate of 45.4% during rainy season in Dehradun district, Uttarakhand, India [8]. The overall incidences of haemoprotozoan diseases *viz.*, theileriosis (37%), babesiosis (10.41%), anaplasmosis (2.82%) was recorded in cross bred cattle in Anand district of Gujarat, India [9]. In Northern Kerala, theileriosis and babesiosis have been reported as 16 % and 0.6%, respectively in crossbred cattle [10]. An outbreak of theileriosis in cattle has been reported from Punjab with 4.86% mortality rate [11].

To undertake effective preventive measures, disease forecasting system must be in place, for which the pattern of disease occurrence in the past years at least 10 years are to be studied. The present study was aimed to find out the prevalence of haemoprotozoan diseases in cross-bred cattle in relation to season, age and breed in Western part of Tamil Nadu, India.

### Materials and Methods

**Study area:** Blood smears were received from the college hospital and veterinary dispensaries in and

**Table-1:** Seasonal pattern of blood protozoan in cattle recorded from January' 2003 to December' 2012 in Namakkal area.

Season	Month	Number of blood smear examined	Theileriosis	Babesiosis	Anaplasmosis	Total no. of positive
Summer	March	230	32	8	10	50
	April	239	41	1	4	46
	May	299	32	1	6	39
	June	216	37	1	5	38
Total		984	142(14.4%)	11(1.1%)	25 (2.5%)	178 (18%)
Mean± S.E			35.50±2.17 <sup>a</sup>	2.75±1.75 <sup>NS</sup>	6.25±1.31 <sup>NS</sup>	
Rainy	July	234	34	2	4	40
	August	229	36	4	8	48
	September	204	28	3	3	34
	October	215	24	3	7	34
Total		882	122(13.8%)	12(1.36%)	22(2.4%)	156 (17.68%)
Mean± S.E			30.50±2.75 <sup>ab</sup>	3.00±0.40 <sup>NS</sup>	5.50±1.90 <sup>NS</sup>	
Winter	November	185	19	2	4	25
	December	222	37	3	4	44
	January	175	17	2	2	21
	February	184	16	2	2	20
Total		776	89(11.5%)	9 (1.0%)	12(1.5%)	110 (14.1%)
Mean± S.E			22.25±4.95 <sup>b</sup>	2.25±0.25 <sup>NS</sup>	3.00±0.577 <sup>NS</sup>	

Mean with similar superscript in a column do not differ significantly ( $p \geq 0.05$ ). NS-Non significant.

around Namakkal area, which is located in Western part of Tamil Nadu. The geographical location of the study lies between 11.00 and 11.360 North latitude and 77.280 and 78.300 East longitude and witnessed a temperature range of 35- 38<sup>o</sup> C with maximum of 42<sup>o</sup> C, relative humidity of 57-55% and rain fall about 1-4". The season in this area can be broadly classified into hot and dry summer from March to June, monsoon season from July to October and the winter season from November to February.

**Study period:** The data recorded in the specimen register of department of Veterinary Parasitology were compiled and analysed for a period of 10 years from January 2003 to December 2012 (Figure-1).

**Sample size:** A total of 2637 blood smears were received from Veterinary College and Research Institute Hospital, Namakkal and Veterinary dispensaries in different places of Western Tamil Nadu.

**Blood smear examination:** Thin blood smears were fixed in methanol (5 minutes) and stained with Giemsa's stain (30 minutes) and were examined under oil immersion lens (100X magnification) for presence of blood parasites. The parasites were identified on the basis of characteristic morphology. Even the presence of a few piroplasms was considered to be positive. Parasitaemia in positive cases was graded as mild or severe by counting at least 10 randomly chosen oil immersion fields (Figure-2).

**Statistical analysis:** Data were statistically analysed using one-way analysis of variance (ANOVA) (SPSS software version 17) at  $p < 0.05$  regarded as statistically significant [12]. All the values were expressed as mean and standard error of mean (SEM) and Microsoft excel was used for presentation of the results.

## Results

The analysis of data on the prevalence of haemo-

protozoan parasites of cattle in Western part of Tamil Nadu for the period from 2003-2012 showed an overall prevalence of 16.64 %. Of which, theileriosis was 13 % followed by anaplasmosis 2.64 % and then babesiosis 1.0%. Among the haemoprotozoan diseases, the prevalence of tropical bovine theileriosis was found to be high, followed by anaplasmosis and babesiosis (Figure-1). It is important to note that, the prevalence of theileriosis has reached peak in the year 2004 and 2007 and also a similar trend was observed with anaplasmosis in the same period. Conversely, there was no fluctuation in the prevalence of babesiosis.

The prevalence of theileriosis was significantly ( $p < 0.05$ ) high during summer (14.4%), followed by moderate in monsoon (13.8%) and less in fair (11.5%) seasons (Table-1). However, there was no significant seasonal influence on the prevalence of babesiosis and anaplasmosis.

Screening of breed wise prevalence data revealed that there was a significantly ( $p < 0.05$ ) high prevalence of haemoprotozoan diseases in Holstein Friesian (HF) and Jersey cross breeds than indigenous breed (Table-2) and the occurrence of these haemoprotozoan diseases was found to be high among the age groups of 2-7 years in cross-bred animals and below 2 years in indigenous animals.

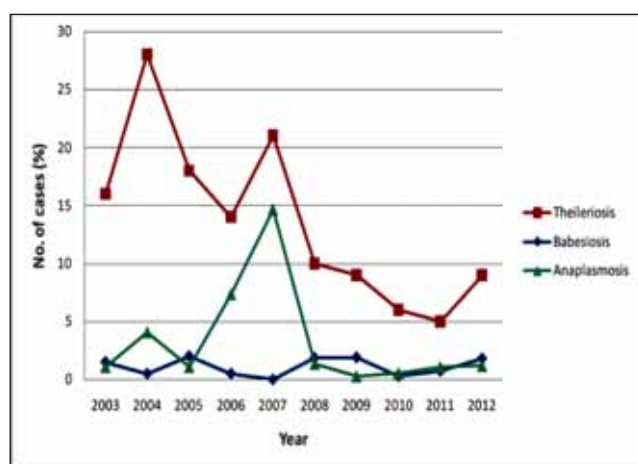
## Discussion

Our retrospective study revealed that 16.64 % of cattle were found infected with haemoprotozoan parasites viz., *Theileria annulata*, *Anaplasma marginale* and *Babesia bigemina* as single or mixed infections. Among the haemoprotozoan diseases, the prevalence of theileriosis was found to be high (13%), followed by anaplasmosis (2.64%) and babesiosis (1.0%). In India, theileriosis is a fatal parasitic disease and has been reported from various geographical regions of the country and recorded as 21.1 % in Tamil Nadu [13],

**Table-2:** Age and breed wise prevalence of blood protozoan in cattle recorded from January' 2003 to December' 2012 in Namakkal area.

Year	Numbers of blood smear examined	No. of positive cases	Breed								
			HF Cross, Age (Years)			Jersey, Age (Years)			ND, Age (Years)		
			2-4	5-7	8-10	2-4	5-7	8-10	0-4	5-7	8-10
2003	201	41	10	19	0	4	8	0	0	0	0
2004	217	71	17	18	0	17	19	0	0	0	0
2005	418	88	20	19	5	20	19	4	1	0	0
2006	231	50	14	9	0	11	15	0	1	0	0
2007	256	66	17	15	1	16	16	1	0	0	0
2008	216	29	9	5	1	6	4	3	1	0	0
2009	315	34	7	11	2	5	6	2	1	0	0
2010	348	22	5	8	1	2	5	1	0	0	0
2011	271	18	3	4	1	2	1	6	1	0	0
2012	164	20	7	2	0	7	3	1	1	0	0
Total	2637	439	109	110	11	90	95	18	6	0	0
Mean± S.E			23.00±3.74 <sup>a</sup>			20.40±4.07 <sup>a</sup>			6.67±0.16 <sup>b</sup>		

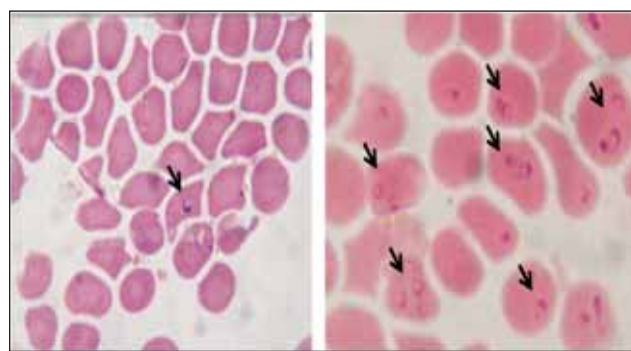
Mean with similar superscript in a column do not differ significantly ( $p \geq 0.05$ ).



**Figure-1:** Prevalence of haematoprotzoan disease in cattle recorded from January 2003 to December 2012 in and around Namakkal area.

16% in Northern Kerala [10], 17.7% in Karnataka [14], 45.4% in Dehradun, Uttarakhand [8] and 4.86% in Punjab [11]. These differences observed in the prevalence may be due to the different geographical locations of the study areas, time periods and various methods of sample analysis. It is interesting to note in the present study that an increased number of concurrent infections of theileriosis and anaplasmosis in the same period may be due to involvement of same species of ticks (probably *Hyalomma* spp.) in the transmission of both the haemoprotzoan diseases. Besides, *Hyalomma* spp. is the most common species of tick infesting cattle in Southern part of India [15, 16] than *Boophilus* spp. [17], which involves in the transmission of babesiosis. This could be the reason why low incidence of babesiosis was observed in this part of Tamil Nadu.

Haemoprotzoan infection, particularly *Theileria* spp. infection reached peak during 2003 and then started declining (Figure-1). This could be due to regular usage of chemical control programme particularly the application of Deltamethrin (0.2% Butox) as a spray on animals and cattle shed which reduced the tick population under field conditions. The slow rise of *Theileria* infection during 2012 might be due to low rainfall and high temperature which favoured propa-



Mild (+)

Severe (++++)

**Figure-2:** Microscopic examination of Giemsa stained blood smear showing piroplasm of *Theileria* parasite (arrow shows the piroplasm stage of *Theileria* spp. in erythrocyte).

gation of tick vector and in turn actively involved in the transmission of haemoprotzoan parasites (Figure-1).

An effort that was made to know the influence of seasonal variation on the prevalence of haemoprotzoan diseases, theileriosis was found to be significantly high during summer (14.4%), followed by moderate in monsoon (13.8%) and less in fair seasons (11.5%). The present investigation is in conformity with the report from Ranchi, Bihar [18], a high prevalence of theileriosis was observed during summer (17.64%), followed by rainy (7.32%) and less in winter (5%). On contrary, a few reports of higher prevalence of theileriosis were observed during monsoon season [9, 19, 20]. The high prevalence of theileriosis observed in the present study may be due to high abundance of tick vector, because high temperature and humidity is ideal for survival and breeding of ticks [21, 22]. While studying the prevalence of babesiosis, it was recorded that highest prevalence during rainy season followed by summer and winter [23, 24], but in the present study, there was no such seasonal influence on babesiosis and anaplasmosis. A considerable seasonal variation with respect to the occurrence of the haemoprotzoan disease may be due to changes in macroclimate that is essential for breeding of ticks.



In the present study, screening of breed wise prevalence data revealed that cross-bred animals were mostly affected than indigenous animals. Breed susceptibility in this study are in line with observation made in crossbred cattle of Bangalore North [25]. Further, it was observed in the present study that the occurrence of these haemoprotozoan diseases were found to be high among the age groups of 2-7 years in both the cross breeds and below 2 years in indigenous animals. This study supports the report witnessing animals over 3 years of age are highly affected by haemoprotozoan diseases in cross-bred animals [26]. On contrary, the occurrence of babesiosis was found even in 15 days to 6 months old calf in this study. This made to suggest that inverse age resistance may fail to protect if there is any problem in maternal antibodies. Most of the cross-bred animals aged around 7 years were in the stage of 3<sup>rd</sup> or 4<sup>th</sup> lactation as peak milk yielders. The weakening of immunity during high milk yielding stage in addition to genetic make up and seasonal stress in summer months could be reason for high susceptibility to this haemoprotozoan parasite.

### Conclusion

The present study suggests that Western part of Tamil Nadu is highly endemic for theileriosis and occurrence of the disease was high during summer. Cross-bred animals, aged 2-7 years are highly susceptible to these haemoprotozoan diseases than indigenous animals.

### Recommendation

The outcome of the present study would help to forecast disease outbreak not only in this region but also applicable to other parts of country. There is a need for further investigations using molecular techniques for the accurate identification of the carrier status of haemoprotozoan parasites.

### Authors' contributions

RV, NR, GP, TJ, TA, KA, KS and PA-blood smear examination and identification of parasites. RV and GP-preparation of manuscript and analysis of data. All authors read and approved the manuscript.

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### Competing interests

The authors declare that they have no competing interests.

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