

Prevalence of haemoprotozoan diseases in cattle of Cauvery delta region of Tamil Nadu

K. Jayalakshmi^{1,5} · M. Sasikala^{2,5} · M. Veeraselvam^{1,5} · M. Venkatesan^{1,5} · S. Yogeshpriya^{1,5} · P. K. Ramkumar^{3,5} · P. Selvaraj^{1,5} · M. K. Vijayasarathi^{4,5}

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Abstract A study was carried out to determine the prevalence of haemoparasites in cattle in Cauvery delta region over a period of one year. A total of 228 giemsa stained blood smears were screened for the presence of haemoprotozoa, out of which 34 animals were found to be positive. An overall prevalence of haemoparasites in the sampled cattle were 14.9%, among this *Anaplasma sp* (8.3%), *Babesia sp* (3.95%), *Theileria sp* (2.19%) and *Trypanosoma sp* (0.44%) as single or mixed blood parasitic infections. In this study Anaplasmosis (14%) was highly prevalent during the winter season and Babesiosis (13.73%) was highly prevalent during summer months followed by Anaplasmosis (9.8%) and Theileriosis (7.8%), the lowest prevalence of Trypanosomiasis was observed during the rainy season. The seasonal variation in prevalence of haemoprotozoan disease might be due to influence of climatic factors on density of vector population in that geographical area. Haemogram revealed decreased level of haemoglobin, packed cell volume and total erythrocyte count. The serum biochemistry revealed elevated level of liver enzyme Asparate transaminase enzyme. All

haemoparasitaemic animals were treated with specific drugs and recovered successfully.

Keywords Cattle · Prevalence · Anaplasmosis · Babesiosis · Theileriosis · Cauvery delta region

Introduction

Haemoprotozoan infections are very common in tropical and subtropical regions of World and cause major economic losses to the livestock industry (Velusamy et al. 2014). It was mainly transmitted by ixodid tick and occasionally through blood transfusion (Salih et al. 2015). The haematophagus tick is not only transmitting the diseases to animals but also indirectly causes anaemia, hide damage and tick paralysis. Haemoparasitaemic animals are anaemic, emaciated with poor productive and reproductive performances and reduced working capacity in bullocks. The global annual economic losses due to tick borne diseases alone US\$18.7 billion, while in India US\$ 498.7 million/annum (Ghosh and Nagar 2014), the estimated annual economic losses due to Tropical Theileriosis alone in India was US \$800 million (Devendra 1995), whereas, losses in Babesiosis and Anaplasmosis was about US\$57 million in India (Anwar 2018). The hot and humid climate is favourable for growth, multiplication and survival of arthropods, which serves as a vector for many blood-borne protozoan diseases (Krishnamurthy et al. 2016). It is clinically manifested as fever, anorexia, anaemia, emaciation, threatened abortion and death in the acute form of infections (Maharana et al. 2016). The animals that recover from acute infection become carriers, creating a potential source of infection to healthy susceptible population (Nair et al. 2011). Early diagnosis and implementation of effective

✉ K. Jayalakshmi
jayalkshm22@gmail.com

¹ Department of Veterinary Medicine, Veterinary College and Research Institute, Orathanadu 614 625, India

² Department of Veterinary Pathology, Veterinary College and Research Institute, Orathanadu 614 625, India

³ Veterinary Clinical Complex, Veterinary College and Research Institute, Orathanadu 614 625, India

⁴ Department of Veterinary Parasitology, Veterinary College and Research Institute, Orathanadu 614 625, India

⁵ Tamil Nadu Veterinary and Animal Sciences University, Chennai 600051, India

treatment are necessary to prevent death and associated production losses. Hence, an attempt was made to study the prevalence of haemoparasites in cattle in the Cauvery delta region of Thanjavur district, Tamil Nadu, India.

Materials and methods

Statement for ethical approval

Clinical study was carried out in Veterinary Teaching Hospital with clinical consent approval.

Sample collection

A total of 228 peripheral blood smears (duplicate) were collected from crossbred and zebu cattle suspected for haemoprotozoan infections on the basis of clinical signs such as anorexia, pyrexia, reduced feed intake, emaciation, enlarged superficial lymph nodes, blanched, pale and icteric conjunctival mucus membrane, haemoglobinuria, nasal discharge, salivation, respiratory distress, coughing, bruxism, diarrhoea, jowl oedema, brisket oedema and sudden drop in milk yield at Large Animal Medicine unit of Veterinary Clinical Complex, Orathanadu from July 2017 to June 2018 for a period of one year. The animals were brought from different places of cauvery delta region of Thanjavur district, Tamil Nadu (India) for treatment.

A 4 ml of blood sample was collected from all 228 animals directly from the jugular vein. About 2 ml of blood was dropped in Ethylene diamine tetra acetate (EDTA) tube and remaining blood let it in a clot activator for haemato-biochemical analysis. The peripheral blood smears were stained with Giemsa stain for 25–30 min after methanol fixation for a minute. The stained blood smears were screened for haemoprotozoa under oil immersion microscope (100×). The parasites were identified based on characteristic morphology described by Soulsby (1982). A minimum of 50 fields were observed under oil immersion find haemoparasites. The haematological parameters in the blood samples such as haemoglobin (Hb), packed cell volume (PCV) and total erythrocyte count (TEC) were carried out by manual method as per the procedures mentioned by Benjamin (2010) and serum biochemical analysis includes total protein, albumin, glucose, blood urea nitrogen, creatinine, total bilirubin, direct bilirubin and aspartate transaminase were carried out as per the procedure mentioned in the kit by Auto analyzer (SELECTRA PRO_{XS} Clinical Chemistry Analyzer, ELITechGroup Clinical System, Netherland).

Results and discussion

In the present study, a total of 228 cattle blood smears were examined, out of which 34 animals were found to be positive for haemoprotozoa. The overall prevalence of haemoprotozoan diseases was 14.9%. This finding was almost similar to that of Velusamy et al. (2014), who reported an overall prevalence of 16.6% in cattle in the western part of Tamil Nadu. Among 228 blood smear examined 19 (8.3%) had *Anaplasma* sp (Fig. 1), 9 (3.95%) harboured *Babesia* sp (Fig. 2), 5 (2.19%) showed *Theileria* sp (Fig. 3) and 1 (0.44%) revealed *Trypanosoma* sp (Fig. 4, Table 1) which occurs as a single or mixed blood parasites. In this study highest prevalence of *Anaplasma* sp was observed followed by *Babesia* sp and *Theileria* sp with the lowest prevalence of *Trypanosoma* sp. Among haemoprotozoan infection the highest prevalence of Anaplasmosis (16.3%) was observed during the winter season (December to February), but it occurs sporadically throughout the year. This is coinciding with the report of Rajasokkappan and Selvaraju (2016), who stated that the incidence of Anaplasmosis in a goat was higher during northeast monsoon and winter season in Ramanathapuram district of Tamil Nadu. During the summer season (March to May) Babesiosis (13.73%) was highly prevalent followed by Anaplasmosis (9.8%) and Theileriosis (7.8%). This is in accordance with the report of Velusamy et al. (2014); Mahmud et al. (2015) and Maharana et al. (2016). They reported the highest prevalence of Theileriosis and Babesiosis during summer season (14.4%) followed by monsoon seasons. This might be due to the abundance of vector population during summer season than other seasons in a year. In this study Trypanosomiasis (0.44%) was



Fig. 1 *Anaplasma* sp in stained peripheral blood smear (100×)

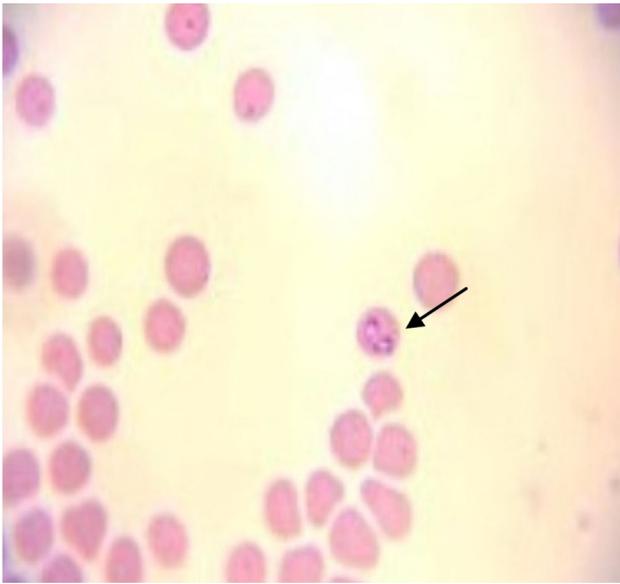


Fig. 2 *Babesia* sp in stained peripheral blood smear (100×)

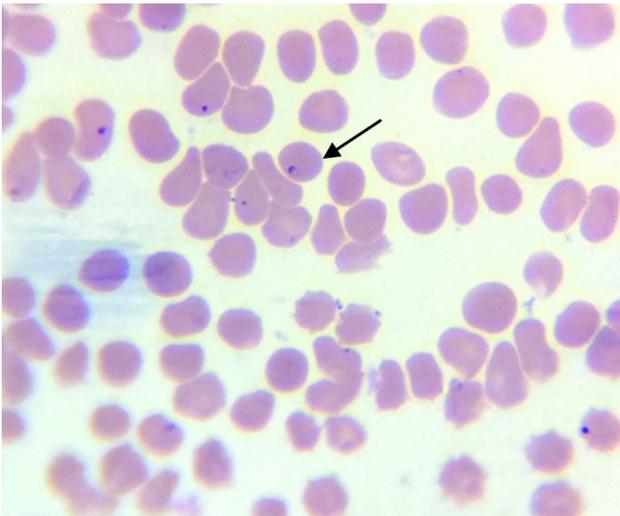


Fig. 3 *Theileria* sp in stained peripheral blood smear (100×)

recorded only in monsoon season. This is in corroborating with the report of Maharana et al. (2016), who observed Trypanosomiasis was a peak around the monsoon season, when the animals are under maximum work-stress owing to agricultural plantations, besides other contributing factors. In our study area, the lowest prevalence of haemoprotozoan infection (7.3%) were observed during rainy and the autumn season (7.9%). It might be due to the low prevalence of tick population in that season. This is contradictory to the observation made by Krishnamurthy et al. (2016). Who have reported the highest prevalence of haemoprotozoan infection (66.6%) during monsoon season in cattle in Shimoga region of Karnataka. This variation might be due to changing climatic conditions. The



Fig. 4 *Trypanosoma* sp in stained peripheral blood smear (100×)

prevalence of the tick was higher in the dry season than a rainy season (Eyo et al. 2014). The incidence of haemoprotozoan diseases varies with geographic area; it depends on climatic conditions such as temperature, humidity and rainfall (Radostits et al. 2000). An increased number of concurrent infection of Anaplasmosis, Babesiosis and Theileriosis were observed in this study might be due to the involvement of vector (tick) *Rhipicephalus* sp in the transmission of haemoprotozoan diseases, as it is the most common tick species found in cattle in the Cauvery delta region.

In this study haematological values were adversely affected in positive cases; Hb, PCV and TEC were reduced to 6.1 g/dl, 19% and 3.82 million/ μ L respectively. In severe parasitemic cases, it was reduced to 1.9 g/dl, 5.4% and 1.23 million/ μ L respectively. Parasitemia in the infected animals were graded as mild (+), moderate (++) and severe (+++) based on parasitic load and their haemoglobin level was decreased to 6.0–7.8, 4.0–5.9 and 1.9–4.0 g/dl respectively. This might be due to the multiplication of an organism in the red blood cells were phagocytosis by reticuloendothelial cells results in haemolytic anaemia. The similar finding was also reported in cattle and buffalo infected with Anaplasmosis, Babesiosis and Theileriosis (Kumar et al. 2015; Rani et al. 2010; Alam and Nasr 2011). In this study, there are no major changes in biochemical value except elevation of Aspartate transaminase (AST) enzyme (224 U/L). This is concomitant with the report of Bork et al. (2004); Alam and Nasr, (2011), who stated that the elevation of liver enzymes in cattle infected with Babesiosis and Theileriosis is due to hepatic damage induced by multiplication of *Babesia* sp in blood and *Theileria* sp in the liver.

Table 1 Seasonal prevalence of Hameoprotozoan diseases in Cauvery delta region of Tamil Nadu

Season	Month	No. of samples screened	Anaplasmosis	Babesiosis	Theileriosis	Trypanosomiasis	No. of samples positive
Rainy/monsoon	June	29	2	–	–	–	2
	July	17	1	–	–	1	2
	August	40	1	–	–	–	1
	September	10	1	1	–	–	2
	Total	96	5	1	–	1	7 (7.3%)
Autumn	October	19	–	–	–	–	0
	November	19	2	–	1	–	3
	Total	38	2	–	1	–	3 (7.9%)
Winter	December	15	1	1	–	–	2
	January	14	3	–	–	–	3
	February	14	3	–	–	–	3
	Total	43	7	1	–	–	8 (18.6%)
Summer	March	19	3	3	1	–	7
	April	17	2	3	–	–	5
	May	15	–	1	3	–	4
	Total	51	5	7	4	–	16 (31.4%)
	Overall	228	19	9	5	1	34 (14.9%)

Since the animal shows clinical disease and confirmed for blood parasitic infection, then treatment was given as per standard protocol (Radostits et al. (2000). The animals positive for Anaplasmosis was treated with Inj. Oxytetracycline @ 20 mg/kg b.wt. in 500 ml normal saline i/v, Meloxicam @ 0.5 mg/kg b.wt. i/m, Belamyl @ 12–15 ml i/m for consecutive five days along with supportive fluid therapy and oral iron supplements (Bol. Ferritas). Those animals positive for Babesiosis and Trypanosomiasis were treated with a single dose of Inj. Diminazene aceturate @ 5.0mg/Kg b.wt. i/m and the Theileria positive cases were treated with Inj. Buparvaquone @ 2.5 mg/kg b.wt. i/m along with supportive therapy and hematinics. The animals recovered after one week of treatment. Recurrence of these infections was not observed following therapy.

Conclusion

The present study concluded that the Cauvery delta region (Thanjavur district) was highly endemic for Anaplasmosis, Babesiosis and Theileriosis. These diseases were higher during summer months due to the high prevalence of tick population. This study could be useful to forecast the diseases based on seasonality. Screening of carrier status is important for early diagnosis and implementation of tick control measures to prevent economic losses in cattle.

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Authors' contribution KJ was involved in sample collection, screening of haemoprotozoa, treatment planning, case follow up and preparation of Manuscript. MS was involved in haematological analysis and go through the manuscript for correction. MV was carried out biochemical analysis of serum samples and go through the manuscript. MV, SY and PKR involved in sample collection. PS was involved in treatment planning and manuscript correction. MKV Confirmed the specific morphology of blood parasites.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

- Alam TH, Nasr SM (2011) Hematological and biochemical investigation in bovine babesiosis and theileriosis. *Benha Vet Med J* 22(2):118–126
- Anwar K (2018) Epidemiology of tick-borne infection in ruminants in Peshawar. *J Adv Parasitol* 5(1):6–10
- Benjamin MM (2010) Haematology in outline of Veterinary clinical pathology, 3rd edn. Kalyani publishers, New Delhi, pp 48–92
- Bork S, Okamura M, Igarashi I (2004) Identification of *Babesia bovis* lactate dehydrogenase as a potential chemotherapeutic target against bovine babesiosis. *Mol Biochem Parasitol* 136:165–172
- Devendra C (1995) In global agenda for livestock research. EDS, ILRI, Nairobi, pp 41–48

- Eyo JE, Ekeh FN, Ivoke N, Atama CI, Onah IE, Ezenwaji NE, Ikele CB (2014) Survey of tick infestation of cattle at four selected grazing sites in the tropics. *Glob Vet* 12(4):479–486
- Ghosh S, Nagar G (2014) Problem of ticks and tick-borne diseases in India with special emphasis on progress in tick control research: a review. *J Vector Borne Dis* 5(1):259–270
- Krishnamurthy CM, Ananda KJ, Adeppa J (2016) Prevalence of Haemoprotozoan infections in bovines of Shimoga region of Karnataka state. *J Parasit Dis* 40(3):890–892
- Kumar T, Sindhu N, Charaya G, Kumar A, Kumar P, Chandratere G, Agnihotri D, Khurana R (2015) Emerging status of anaplasmosis in cattle in Hisar. *Vet World* 8(6):768–771
- Maharana BR, Teswari AK, Saravanan BC, Sudhakar NR (2016) Important hemoprotozoan diseases of livestock: Challenges in current diagnostics and therapeutics: an update. *Vet World* 9(5):487–495
- Mahmud MAA, Belal SMSH, Hossain MA (2015) Prevalence of theileriosis and babesiosis in cattle in Sirajganj district of Bangladesh. *Res Agric Livest Fish* 2(1):79–86
- Nair AS, Ravindran R, Lakshmanan B, Kumar SS, Tresamol PV, Saseendranath MR, Senthilvel K, Rao JR, Tewari AK, Ghosh S (2011) Haemoprotozoa of cattle in Northern Kerala, India. *Tro Biomed* 28(1):68–75
- Radostits OM, Blood DC, Gay CC, Hinchcliff KW (2000) *Veterinary medicine—a text book of the disease, sheep, goats, pigs and horse*, 9th edn. ELBS, Baillier, London
- Rajasokkappan S, Selvaraju G (2016) Prevalence of anaplasmosis in goats in Ramanathapuram district of Tamil Nadu. *Int J Sci Environ Technol* 5(2):511–514
- Rani NL, Sreedevi C, Annapurna P, Aswani Kumar K (2010) Clinical management and haemato-biochemical changes in babesiosis in buffaloes. *Buffalo Bull* 29(2):92–94
- Salih DA, El-Hussein AM, Singla LD (2015) Diagnostic approaches for tick borne haemoparasitic diseases in livestock. *J Vet Med Anim Health* 7(2):45–56
- Soulsby EJJ (1982) *Helminths, arthropods and protozoan of domesticated animals*, 7th edn. Bailliere Tindall and Cassell Ltd., London
- Velusamy R, Rani N, Ponnudurai G, Harikrishnan TJ, Anna T, Arunachalam K, Senthilvel K, Anbarasi P (2014) Influence of season, age and breed on prevalence of haemoprotozoan diseases in cattle of Tamil Nadu, India. *Vet World* 7:574–578

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