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Haematological investigation and identification of tick infestation in crossbred cattle

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Abstract
The present study was conducted to gather information about the prevalence of tick species and effect on haematological parameters in tick infested crossbred cattle for which 20 crossbred animals were included in the study [non-infested (10) and infested with tick (10)]. The present study revealed that there was a significant decrease (p<0.05) in haemoglobin (g/100 ml), packed cell volume (%), red blood corpuscles (10^6/mm^3), total leucocytes count (10^3/mm^3), neutrophils (%) and monocytes (%) whereas lymphocytes (%) and eosinophils (%) were found to be significantly (p<0.05) higher in infested animals than non-infested/ healthy animals. In the present study, *Rhipicephalus species* was found to be the most prevalent tick out of all the ticks collected from different parts of the body. Monitoring of haematological parameters with accurate identification of tick species can be useful to understand the gravity of the infestation and for better diagnosis, formulating Integrated Pest Management (IPM) strategy for successful prescription treatment, control and prognosis.

Keywords: Crossbred cattle, haematological parameters, IPM, *Rhipicephalus*, tick

Introduction
One of the key pillars of India's agrarian economy, food and nutritional security, and way of life is livestock. With 193.46 million cattle and 109.85 million buffaloes in the organized and unorganized sectors, India has the greatest livestock resource in the world, contributing 97% to the country's milk supply (BAHS, 2022-23) [3]. Perusal of livestock census reveals that productivity has significantly decreased, primarily due to issues with management practices, nutriton and health care. For farmers, parasite infection is a serious problem in addition to infectious diseases. Among these, ticks are obligate haematophagous ectoparasites, economically one of the most important pests of cattle, buffalo and other domestic animals in the world (Jongejan and Uilenberg, 1994) [12], especially under tropical and sub-tropical climatic condition. Compared to native cattle and buffalo, crossbred animals are more susceptible to tick infestation, which results in economic losses, including loss of production (milk and meat), deterioration of skin and hide quality, and the spread of diseases that are expensive to prevent and treat (Gracia, 2003) [10]. It has been reported that on an average of 40 ticks a day can cause body weight loss of 20 kg/annum (Frisch *et al.*, 2000) [5] and one engorged female tick can reduce milk yield by 8.90 ml/day/gram live weight gain (Jonsson *et al.*, 1998) [13] with a total loss of around 529 kg milk/lactation (26%) in HF cows (Teodoro *et al.*, 1998) [24] and 23% milk yield/day in crossbred (Furlong *et al.*, 1996) [6] infested with ticks. Through the synthesis of tick toxin, it is also linked to a decrease in hunger (due to discomfort from tick bites and its influence on the host's metabolism) and body weight (Seebeck *et al.*, 1971) [22]. These toxins interfere with the erythropoiesis process and decrease bone marrow function, which results in intravascular hemolysis of red blood cells and anemia (Ibrahim *et al.*, 2009) [11]. According to Lew- Tabor and Valle (2016) [16], ticks and tick-borne diseases (TTBDs) cause an estimated loss of 22–30 billion US dollars year whereas the projected cost of TTBD control in India is 498.7 million US dollars annually (Minjauw and McLeod, 2003) [17]. In order to effectively decide on management tactics, various IPM strategies have been developed for the tactical use of acaricides for tick control (Barnard *et al.*, 1994; Schmidtmann, 1994) [2, 21]. These strategies require time-consuming and labor-intensive actions from farmers in the form of tick load monitoring and quantification (Barnard, 1985) [1]. Timely gathering and inspection of animals is an expensive task, so the majority of farmers treat animals according to a seasonal schedule based on their regular management practices (gathered for sorting, branding, and vaccinations) regardless of tick type and tick density, which leads to the development of resistance and makes tick control much more challenging in

the near future. Therefore, in order to determine the severity of the infestation and for better diagnosis, successful treatment, and prognosis (Col and Uslu, 2007 [4]; Nazifi *et al*., 2010 [18]), new, non-invasive, and cost-effective methods of parasite detection should be correlated with haematological and sero-biochemical changes in the host body. This will help to formulate an effective IPM strategy in advance to improve overall animal health and productivity. Keeping this in view, the present study is designed to investigate the effect of tick infestation on the haematological parameters with identification of tick species in naturally infected crossbred HF cattle in the selected population to create new avenues of managemental tool for optimizing productivity.

Materials and Methods

The study was conducted in Livestock Research Centre (LRC), located at ICAR-National Dairy Research Institute (ICAR-NDRI), Karnal, Haryana in a geographic orientation with an elevation (attitude) of 250 meters above the mean sea level, latitude 29°43" North and longitude 77°20" East. Ethical approval (number 45-IAEC-19-3) was sought from the Institutional Animal Ethics Committee (IAEC) at ICAR-National Dairy Research Institute for protocols followed and the animal's management in the experiment.

Tick collection and identification of species

Care had been taken to remove mouthparts of tick since the mouth parts were firmly embedded in the host's skin. Ticks were preserved in 70% alcohol. Collected ticks were boiled in 10% NaOH for 5 to 10 minutes to render scutum transparent. Excess NaOH was washed in the water and then dehydrated in ascending grades of alcohol (70%, 90% and absolute). Then the ticks were kept in carbolic acid for 5 minutes and after that mounted in Canada balsam with the ventral side up. Then mounted ticks were observed under microscope for identification.

Blood parameter analysis

The animals were maintained under uniform management conditions. Twenty crossbred cattle aged between 12 to 24 months infested with ticks were selected randomly. The animals were not subjected to acaricide treatment. 2 to 3ml blood was collected using EDTA vacutainer from each animal and immediately subjected to blood profile by using an automatic blood analyser (Nihon kodhencelltaca, Tokoyo, Japan).

Statistical analysis

Statistical analysis was performed by using the SPSS 20.0 software (IBM Corporation, Armonk, New York, USA). The data of blood parameters were analysed by using independent t-test.

Results and discussion

In the present study, out of 100 ticks collected from different crossbred animals and from different parts of the body and interestingly it has been observed that *Rhipicephalus spp* was present majorly (Fig 1).

Fig 1: *Rhipicephalus* spp.

There were possibilities of presence of other tick species if more number of ticks could have been processed. The predominance of *Rhipicephalus spp.* has also been reported by various authors (Soulsby, 1982; Rodriguez *et al*., 2011; Khajuria *et al*., 2015) [23, 20, 15]. Soulsby, (1982) [23] reported that, *Rhipicephalus spp.* was more prevalent in cattle in various geographical areas around worldwide due to its great capacity for adaptation and propagation. Khajuria *et al.* (2015) [15] and Ghosh *et al.* (2018) [9] reported that cattle were commonly infested with *Rhipicephalus spp*. In India, it is also the most prevalent tick in different agroclimatic zones affecting various age groups of cattle, horse, sheep, goat and deer (Ghosh *et al*., 2007) [8]. Approximately 1 billion bovines were at risk of being affected by these parasites globally (Rodriguez *et al*., 2011) [20].

Haemoglobin (g/100 ml), packed cell volume (%), red blood corpuscles (10^6/mm^3), total leucocytes count (10^3/mm^3), neutrophils (%) and monocytes (%) were significantly ($p<0.05$) lower while lymphocytes (%) and eosinophils (%) were found to be significantly ($p<0.05$) higher in tick infested animals compared to non-infected animals (Table 1).

Table 1: Mean ± S.E. of blood parameters of tick-infested (n=10) and non-infested (n=10) crossbred cattle

Parameters	Non infested animals	Infested animals
Haemoglobin (gm/100 ml)	11.85^a ±0.63	07.31^b±0.55
Packed cell volume (%)	37.00^a±2.42	22.70^b±0.47
Red blood corpuscles (10^6/cmm)	07.00^a±0.38	05.28^b±0.20
Total leucocytes count (10^3/cmm)	09.63^a±0.83	05.09^b±1.13
Neutrophils (%)	34.50^a±1.20	27.90^b±1.80
Lymphocytes (%)	64.17^a±0.98	68.60^b±1.97
Eosinophils (%)	00.67^a±0.33	02.70^b±0.37
Monocytes (%)	00.67^a±0.21	00.80^b±0.25

Means bearing different superscripts in a row differs significantly ($p<0.05$).

Similar to our observation, various authors reported lower total leucocyte count, RBC, neutrophils, Hb and PCV (Raut *et al*., 2008; Kaur *et al*., 2017) [19, 14] and higher lymphocyte and eosinophils (Gebelhoff, 1974; William *et al*., 1978; Kaur *et al*., 2017 [14]) [7, 25, 14] in tick-infested animals compared to healthy animals. Monitoring haematological and sero-biochemical changes can help to understand the infestation's gravity and better diagnosis, successful treatment and prognosis (Col and Uslu, 2007; Nazifi *et al*., 2010) [18, 4]. However, this loss of blood via tick sucking resulted in

retarded growth and lowered body weight. The decrease in RBC counts is associated with the blood-sucking habit of ticks, which sometimes lead to anaemia associated decrease in Hb. The nutritional depression due to tick infestation may also be associated with a decrease in haematocrit and haemoglobin in various livestock breeds. The increase in lymphocytes count and eosinophil may be associated with inflammation caused by the tick bite.

Conclusion

The findings of this study show that the haematological parameters of tick-infested crossbred cattle significantly decreased. The findings of the present study and other comparable studies highlight the significance of the changes in haematological parameters (known as "markers of parasitism") caused by tick infestation, which have a significant impact on the wellbeing and productivity of dairy animals. Based on these findings, it can be concluded that *Rhiphicephalous spp.* is the most prevalent tick in the studied population. To further establish the impact of tick infestation on haematological and pathological parameters in cattle and other domestic animals in various regions of the country, research for non-invasive tick detection must be conducted. In order to make a more accurate diagnosis and implement IPM effectively, correct treatment and control methods should be employed together with appropriate molecular research.

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References

1. Barnard DR. Injury thresholds and production loss functions for the lone star tick, Amblyomma americanum (Acari: Ixodidae), on pastured, preweaner beef cattle, Bos Taurus. J Econ. Entomol. 1985;78(4):852-855.
2. Barnard DR, Mount GA, Haile DG, Daniels E. Integrated management strategies for Amblyomma americanum (Acari: Ixodidae) on pastured beef cattle. J Med. Entomol. 1994;31(4):571-585.
3. Basic Animal Husbandry Statistics, 2022; Accessed from https://dahd.nic.in/schemes/programmes/animal-husbandry-statistics
4. Col R, Uslu U. Changes in selected serum components in cattle naturally infected with Theileria annulata. B. Vet. I. Pulawy. 2007;51:15.
5. Frisch JE, O'neill CJ, Kelly MJ. Using genetics to control cattle parasites-the Rockhampton experience. Int. J Parasitol. 2000;30:253-264.
6. Furlong J, Deresz F, Matos LD, Balbi MV. The effect of cattle tick Boophilus microplus (Acari: Ixodidae) infestation on feed intake and milk yield of Holstein x Zebu crossbred cows. Proccedings of 15th Congresso Panamericano de Veterinária, Campo Grande, MS, Brazil; 1996, P. 340.
7. Gebelhoff E. Effect of tick infestation with B. decoleratus and Ha excavatum on blood picture of calf (Doctoral dissertation, Frele Univ. Berlin), 1974.
8. Ghosh S, Azhahianambi P, Yadav MP. Upcoming and future strategies of tick control: A review. J Vector Dis. 2007;44:79-89.
9. Ghosh S, Patra G, Borthakur SK, Behera P, Tolenkhomba TC, Das M, *et al*. Prevalence of hard tick infestations in cattle of Mizoram, India. Biol. Rhythm Res. 2018;50:564-574.
10. Gracia Z. Integrated control of Boophilus microplus in cattle. Proc. 11th Int. Congr. Int. Society for Animal Hygiene, Mexico City, Mexico; c2003.
11. Ibrahim AK, El Behairy AM, Mahran KA, Awad WS. Clinical and laboratory diagnosis of piroplasmids in naturally infected cattle in Egypt. J Egypt. Vet. Med. Assoc. 2009;69(2):105-203.
12. Jongejan F, Uilenberg G. Ticks and control methods. Rev Sci Tech Oie. 1994;13:1201-1226.
13. Jonsson NN, Mayer DG, Matschoss AL, Green PE, Ansell J. Production effects of cattle tick (*Boophilus microplus*) infestation of high yielding dairy cows. Vet. Parasitol. 1998;78:65-77.
14. Kaur D, Jaiswal K, Mishra S. Epidemiological study of ixodid ticks infesting cattle reared by small holder farmers. J Entomol. Zool. Stud. 2017;4:284-291.
15. Khajuria V, Godara R, Yadav A, Katoch R. Prevalence of ixodid ticks in dairy animals of Jammu region. J Parasit. Dis. 2015;39:418-421.
16. Lew-Tabor AE, Valle MR. A review of reverse vaccinology approaches for the development of vaccines against ticks and tick borne diseases. Ticks Tick Borne Dis. 2016;7:573-585.
17. Minjauw B, McLeod A. Tick-borne diseases and poverty. The impact of ticks and tick borne diseases on the livelihood of small-scale and marginal livestock owners in India and eastern and southern Africa. Research Report, DFID Animal Health Programme, Centre for Tropical Veterinary Medicine, University of Edinburgh, UK; c2003.
18. Nazifi S, Razavi S, Reiszadeh M, Esmailnezhad Z, Ansari-Lari M. Diagnostic values of acute phase proteins in Iranian indigenous cattle infected with Theileria annulata. Vet. Arh. 2010;80:205-214.
19. Raut PA, Sonkhusale VG, Khan LA, Nakade MK, Pagrut NS, Bodkhe AM. Haematological changes in cattle associated with arthropods infestation. Vet. World. 2008;1:338.
20. Rodriguez R, Ojeda M, Pérez L, Rosado J. Epidemiología y control de Rhipicephalus (Boophilus) microplus en México. In: Quiroz H, Figueroa J, Ibarra F, López M, editors. Epidemiología de enfermedades parasitarias en animals domésticos. México: UNAM. 2011, 477-504.
21. Schmidtmann ET. Ecologically based strategies for controlling ticks. New York: Oxford University Press; c1994. p. 240-280.
22. Seebeck RM, Springell PH, O'Kelly JC. Alterations in the host metabolism by the specific and anorectic effects of the cattle tick (*Boophilus microplus*) in food intake and body weight growth. Aust. J Biol. Sci. 1971;24:373-380.
23. Soulsby EJL. Helminths, Arthropods and Protozoa of Domesticated Animals, 7th ed. Bailliere Tindall, London; 1982, p. 35-778.
24. Teodoro RL, Lemos AM, Madalena FE. Effects of ticks Boophilus microplus infestations on milk yield of Bostaurus/Bosindicus crosses. In Proceedings of the 6th World Congress on Genetics Applied to Livestock Production, Armidale, Australia; c1998. p. 137-180.
25. William RE, Hair JA, McNew RW. Effects of Gulf Coast ticks on blood composition and weights of pastured Hereford steers. J Parasitol. Res; c1978. p. 336-342.