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Ecological and epidemiological survey of Tick species: Prevalence and identification on Cattle and Buffaloes in Nanded region of Maharashtra, India

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ABSTRACT

This research gives an important seasonal assessment of tick prevalence and type of infestation caused to cattle and buffaloes in Nanded district. Earlier studies suggest that ticks may be linked to diseases affecting cattle and buffaloes. Taxonomical identifying keys have not received much attention from researchers. This study not only looks at the seasonal prevalence of ticks on cattle and buffaloes but also compares which animal is more heavily infested. It also shares details on the different tick species found in the samples. This work offers a new method for measuring prevalence by using a simple formula intended. The percentage of cattle was found to be 30.26%, with the monsoon season marking a significant surge in this prevalence. On the other hand, the summer and winter seasons, recording 20.51% and 20.32%, respectively. 34.49% of buffaloes were found to be present, with the monsoon season showing the highest incidence. The prevalence showed little variation between summer and winter, with rates of 34.29% and 32.59%, respectively. Rhipicephalus microplus, Rhipicephalus annulatus, Rhipicephalus decoloratus, Rhipicephalus sanguineus, and Haemophysalis longicornis are the four species that have been identified within the Rhipicephalus genus.

KEYWORDS

Prevalence Count, *Rhipicephalus microplus, Rhipicephalus sp,* Cattle Breed, Buffalo Breed, Tick

HOW TO CITE THIS ARTICLE

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Tick is a classical concern in companion animal health. Prevalence counting and identification of these creepy, crawly creatures is key to understanding tick-borne diseases. Research in this area has confirmed that ticks are a member of the arachnid family, particularly the order parasitiformes, which includes both mites and ticks, with many being of a parasitic nature and feeding off one another. Ticks are key vectors for the circulation of medically important organisms and display parasitic adaptations. Ticks are known to transmit a wide variety of diseases to vertebrate animals.

Ticks are ectoparasites which infest many animals like cattle, buffalo, sheep, goats, dogs, deer and humans. In addition to their importance, ticks are vectors of theileriosis, anaplasmosis, babesiosis and rickettsiosis in domestic animals with non-specific clinical signs such as anemia, dermatosis, toxicosis and paralysis. The control of tick-borne diseases mainly depends on the control of vectors (S. Gosh, 2006). There are relatively few historical works in the area of tick infestation that the effect of tick infestation may be more severe on the suckling calf of a cow which is infested than on the adult animal itself (M. M., Scholtz, 1991).

Extensive inquiry has proved that Arachnids such as ticks are blood-sucking parasites that consume blood meals at regular intervals. Ticks display sexual dimorphism and can be either monoecious or dioecious, with distinct morphological characteristics. Ticks need at least one, two, or sometimes multiple hosts to finish their life cycle. Life cycles of certain species are either confined to a single host, involve two hosts, or take place across three or more hosts. Ticks undergo four developmental stages as part of their complete life cycle: egg, larval, nymph, and adult stages. These organisms exhibit slight physical differences at various stages, despite being members of the Arachnida class, which is characterized by the presence of four pairs of legs. The larval stage of ticks possesses only three pairs of legs, which makes it difficult to distinguish from members of the class Insecta. There are comparatively few historical works in the area of tick identification Ticks are ectoparasites of livestock which are belong to the Phylum Arthropod, Class Arachnida and order Acari (Barker and Murrell, 2004).

Three families are currently recognized: Ixodidae (hard ticks 692 species), Argasidae (the soft ticks, with 186 species) and the recently identified Nuttalliellidae which exhibits intermediate characteristics in comparison which contains only one species (*Nuttalliela namaqua*) (Naval *et al*., 2010). The first two families comprise tick species that are important vectors of disease causing agents to animals and humans. These zoonotic agents are maintained in cycles between ticks and reservoir hosts, where humans can develop clinical illness but usually are "dead-end" hosts because they do not contribute to the transmission cycle (Swanson *et al*., 2006 and Bekalu Gerem Eskezia, 2016). The questions of research in this study were focused on this locality, including the prevalence count. These are exploration questions specifically regarding the identification of the Tick samples collected during the field work.

Review of Literature

The previous research work on the Ticks suggests that frequent dipping is essential to avoid drastic losses in productivity when exotic breeds, with a high susceptibility to tick infestation, are utilized in farming areas with a high tick incidence.

India is predominantly an agricultural country with about 70% of her population dependent on income from agriculture. The use of indigenous breeds that possess a very high resistance to tick infestation may be a solution to the dilemma of infestation and frequent dipping in the undeveloped parts of Africa, as pointed out by (Norval *et al*., 1988a). This may be accompanied by strategic dipping e.g. dipping every 3 weeks during the wet season and only when necessary in the dry season. To a large extent this strategy will prevent the loss of endemic stability. Although India accounts for a significant share of world's livestock resources, livestock production is greatly affected by ticks and tick-borne diseases (TTBDs). Therefore, India represents a particularly interesting scenario for the study of TTBDs. Here in; we review the problems and opportunities for the integrated control of ticks of ruminants with special emphasis on livestock farming systems in India. Developments discussed in the review in the area of tick vaccines and other tick control measures should have an impact on the future of Indian livestock production.

Rhipicephalus (Boophilus) microplus is considered one of the most important ectoparasites of cattle worldwide. Due to the increase in the number of water buffaloes (*Bubalus bubalis*) in *R. microplus*-infested areas, this study was designed to determine whether these ruminants are able to sustain the complete tick life cycle. To this aim, a seven-month old water buffalo of the Mediterranean breed and a *Holstein bovine* of the same age, both tick-naïve, were infested with *R. microplus* tick larvae, and the parasitic and non-parasitic tick stages were analyzed and compared. The studied parameters include the number of recovered engorged females, the time points at which the first and last engorged females fell to the ground; the pre-oviposition duration, the percentage of hatching and the reproductive efficiency index. No statistically significant differences were found between the buffalo and the bovine in all parameters measured. It was concluded that the water buffalo can act as a suitable reservoir for *R. microplus* ticks. These results should be taken into account when implementing tick control and eradication campaigns in water buffalo grazing lands. Ticks are obligate haematophagous ectoparasites of domestic and wild animals as well as humans, considered to be second world-wide vectors of human diseases.

They are the most important ectoparasites of livestock in tropical and sub-tropical areas, and are responsible for severe economic losses both through the direct effects of blood sucking and indirectly as vectors of pathogens. The present review is focused on impact of tick on livestock productivity and health. Loss of blood is a direct effect of ticks acting as potential vector for haemo-protozoa and helminth parasites. Blood sucking by large numbers of ticks causes reduction in live weight and anemia among domestic animals, while their bites also reduce the quality of hides and skin. The impact of ticks on livestock production and health includes tick borne disease morbidity and mortality, huge loss of milk and meat production, damage on the quality of skin and hide and cost for tick and tick borne disease control and prevention. The economic losses due to ticks can be expressed either in terms of body weight or milk production lost or treatment cost employed for its prevention and control. The implementation of rational and sustainable tick control programs in grazing animals is dependent upon the knowledge of the ecology and epidemiology of ticks. Major tick controlling techniques such as biological and chemical control methods, grazing management, genetic manipulation and vaccination could be employed. The prolonged and incorrect use of tick chemicals can lead to resistance in ticks, enabling the ticks to tolerate and survive chemical applications and making tick control in the future much more difficult.

Therefore, appropriate method of control and prevention of ticks should be formulated based on the ecological and epidemiological study done ahead of time, appropriate tick drug handling and management should be practiced to prevent the drug resistance and deep investigation should be done on the preparation and application of vaccines which could be a successful prevention method in the future.

Methodology

The samples are collected from the different localities of Nanded district. Samples are collected from the body of different Cattles and Buffaloes by using forceps, from different body parts like ventral side of neck, back side of ears, ventral side of in mid of forelegs while this collection work the care was taken that no animal gets harmed. The animals were infected by ticks and were having marks on body. Different methods have been proposed to identify amongst which I have used the pictorial key and a tick guide for identifying the tick species. Another advantage of employing identification methods discussed above is that it provides ease to identify the species quickly by comparing the previous sketches in pictorial keys and the sketches made by researcher during research.

Figures

The images given were gathered during the collection procedure, these images displaying the symptoms and skin allergic reactions on cattle and buffaloes due to tick infestation.

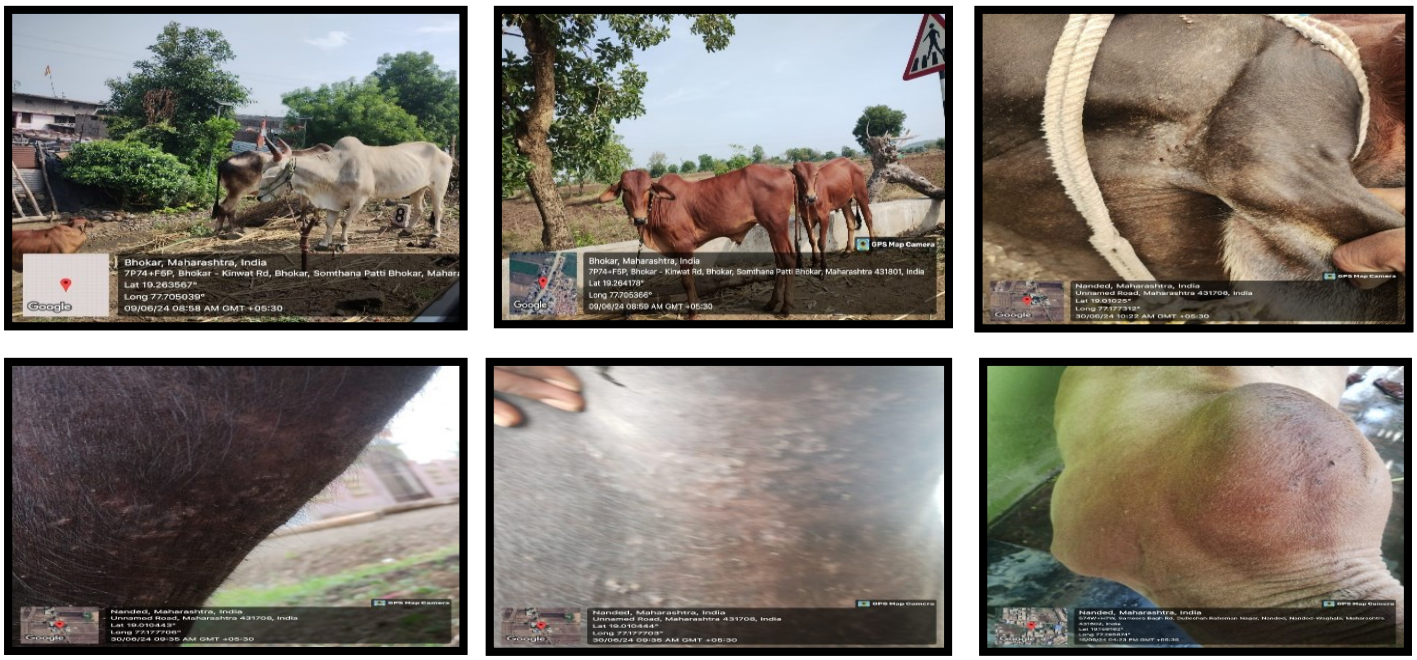


Fig 1. Symptoms and skin allergic reactions on cattle and buffaloes due to tick infestation

Fig 2. ***Rhipicephalus annulatus***

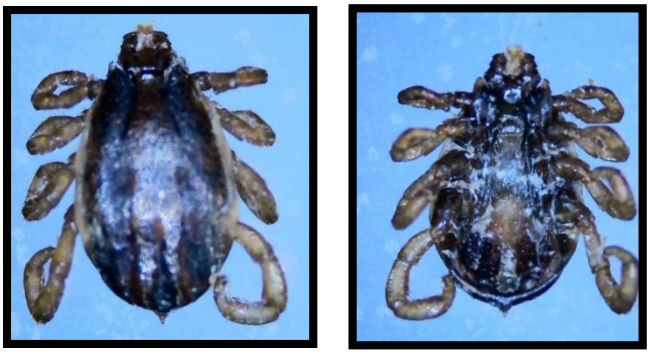


Fig 3. ***Rhipicephalus microplus***

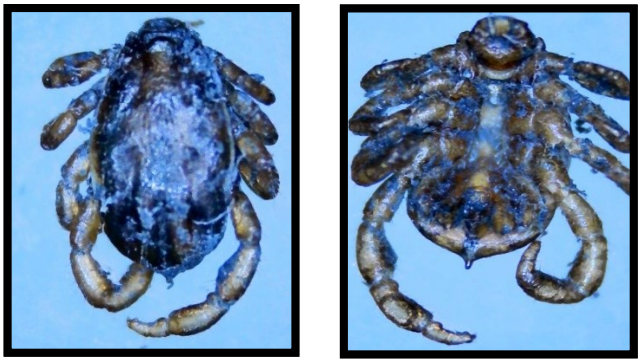


Fig 4. ***Rhipicephalus decoloratus***

Fig 5. ***Rhipicephalus sanguineus***

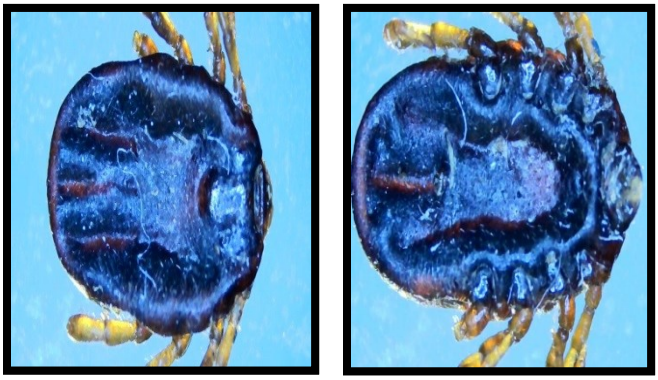


Fig 6. ***Haemophysalis longicornis***

Observation

A fundamental statistical analysis was performed to assess the occurrence of tick infestations in cattle and buffaloes throughout the year 2024. This examination facilitated the assessment of infestation rates across various seasons and species. Furthermore, tick species were recognized from field samples according to their unique morphological traits. Visual depictions of the identified ticks, along with essential identification characteristics, were incorporated to aid in the species classification and improve the comprehension of the tick populations involved in the research. The infestation rates in cattle by breed. The Red Khandari breed exhibited the highest level of infestation during the winter season, with 27 out of 105 individuals affected. The Gyr breed demonstrated a consistent pattern of infestation across seasons, with a notable increase during the monsoon, where 21 out of 89 individuals were infested. The Sahiwal breed showed relatively low infestation rates throughout all seasons. In contrast, the Halikar breed experienced moderate infestation levels across seasons, with a peak during winter, where 7 out of 105 individuals were affected.

The highest prevalence rate of infestation is observed during the monsoon season, with a rate of 30.26%, followed by summer (20.51%) and winter (20.32%). While the total number of infested cattle is greater during the monsoon, the prevalence rate for summer (20.51%) is marginally higher than that of winter (20.32%). The infestation in Buffaloes by breed Murrah buffaloes exhibited the highest infestation levels in both the winter and monsoon seasons, with 37 individuals affected in each season, while a moderate infestation level was observed during the summer (29 affected). Jaffery buffaloes demonstrated moderate infestation levels across all seasons, with the highest count recorded in winter (25 infested). Gujjar buffaloes consistently exhibited the lowest infestation levels across all seasons, with the highest number of affected individuals occurring in winter (21 infested). The monsoon season recorded the highest prevalence rate of infestation, at 34.49%, followed closely by winter at 34.29%, and summer at 32.59%.

Although fewer buffaloes were surveyed during the summer (91 buffaloes), the infestation rate remained relatively high compared to the winter (120 buffaloes) and monsoon (113 buffaloes) seasons. Despite these variations in survey size, the prevalence rates across the three seasons exhibited minimal differences. Closer inspection of the table displays that the mean prevalence of Cattle is 23.70% and the mean prevalence of Buffalo is 33.79% respectively. What is peculiar about this result is that Buffaloes are having high prevalence than cattle. The most likely reasons of high prevalence in Buffaloes could be dark colour of coat to improve the capacity for concealment. Throughout this study, five species belonging to the *Rhipicephalus* genus were recognized: *Rhipicephalus microplus, Rhipicephalus annulatus, Rhipicephalus decoloratus Rhipicephalus sanguineus* and *Haemophysalis longicornis*. Species in the *Rhipicephalus* genus are obligate ectoparasites, indicating that they completely rely on blood meals from their hosts for their survival and cannot exist without this parasitic relationship. These species display sexual dimorphism, a trait often seen in ticks, characterized by notable morphological differences between males and females. Such dimorphism can be seen in attributes such as size, shape, and particular anatomical features, which act as crucial diagnostic indicators for species identification.

The Rhipicephalus ticks present a significant veterinary issue owing to their role as vectors for multiple economically important tick-borne illnesses, including babesiosis and anaplasmosis, which impact livestock. Correct identification of these species, based on morphological traits and their ecological interactions, is essential for creating focused control strategies and managing disease programs. The male ticks of *Rhipicephalus species* display a unique posterior projection at the tip of their bodies, varying in both shape and visibility among the different species called “ventral plate spurs”. In *R. annulatus*, this spurs are particularly short and wide, making it invisible when viewed from the dorsal aspect of the body. Conversely, *R. decoloratus* features a pointed posterior projection that is readily apparent from a dorsal view. Likewise, *R. microplus* possesses a projection visible dorsally, but it has a blunt shape, setting it apart from *R. decoloratu*s.

These subtle variances in the male's posterior projection morphology serve as significant taxonomic indicators for differentiating among these closely related tick species, facilitating precise species identification in both fieldwork and laboratory analyses. *Rhipicephalus annulatus* is commonly known as the Cattle tick. Adult female ticks are approximately 6-9 mm in length. Adult male ticks of this group are smaller, around 4-6 mm in length. Shape of this tick is oval, slightly flattened body typical of hard ticks. The smooth-edged scutum is lighter than the rest of the body. The anal shield in females is rectangular and located at the posterior end of the body. *R. annulatus* can be identified by its reddish-brown scutum, absence of festoons, shorter palps, and barbed hypostome. These characteristics are essential for distinguishing it from similar species of ticks. *Rhipicephalus microplus* is commonly known as the tropical cattle tick or Southern cattle tick.

In this species of *Rhipicephalus* genus adult females are approximately ranges 6-10 mm in length and adult males are slightly smaller, ranging around 4-6 mm in length. The oval shaped or elongated, flattened body typical of *R. microplus*. The scutum it has a smooth margin, and its color is lighter than the rest of the body, often yellowish-brown or tan. The anal shield in females is rectangular and located at the posterior end of the body near the anus.

Rhipicephalus decoloratus is commonly known as the blue tick. Adult females in this species are approximately 5-8 mm in length, whereas adult males are slightly smaller than the females, about 4-6 mm. The shape is oval, flattened body typical of *R. decoloratus*. The scutum it has a clear, smooth margin and is usually lighter in color than the rest of the body. The anal shield in females is rectangular and located at the posterior end of the body, near the anus. *Rhipicephalus sanguineus* is commonly known as the brown dog tick. Adult females are about 4-5 mm in length and adult males are slightly smaller than the female, around 3-4 mm. Shape is oval, flattened body typical of *Rhipicephalus sanguineus* ticks. The scutum is distinct and covers only part of the dorsal side. It has a clear border and is a key feature for identification.

They are relatively short compared to other tick species. The anal shield is present in females and is typically rectangular or square. *Haemophysalis longicornis* commonly known as the longicorn tick. Adult females are approximately 4-6 mm in length and adult males smaller than the female, about 3-4 mm. Shape is oval or shield-shaped body typical of hard ticks. The scutum is notched and may have a distinct pattern that helps differentiate it from other ticks. The legs are generally long, thin, and have distinct segments.

Sketches of Ticks

During this study the sketches for identification work.

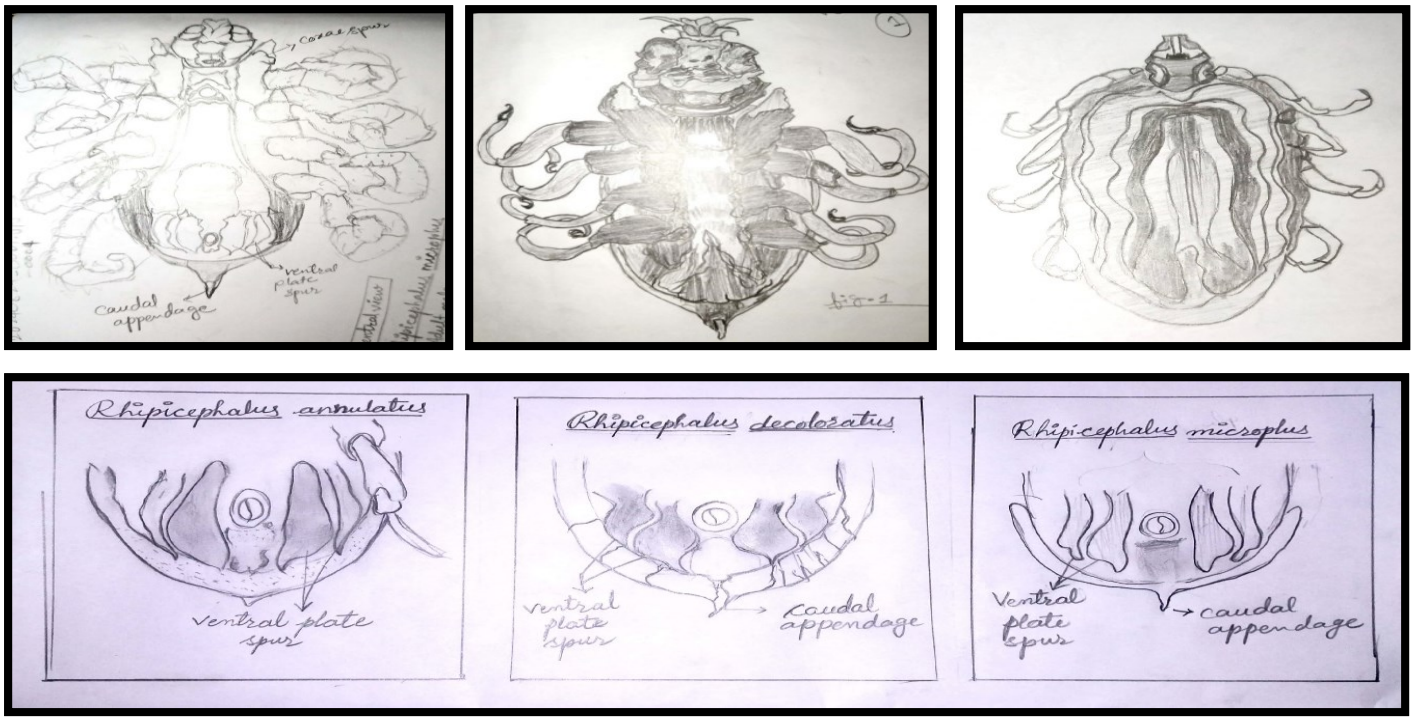


Fig 7. Sketches for identification work

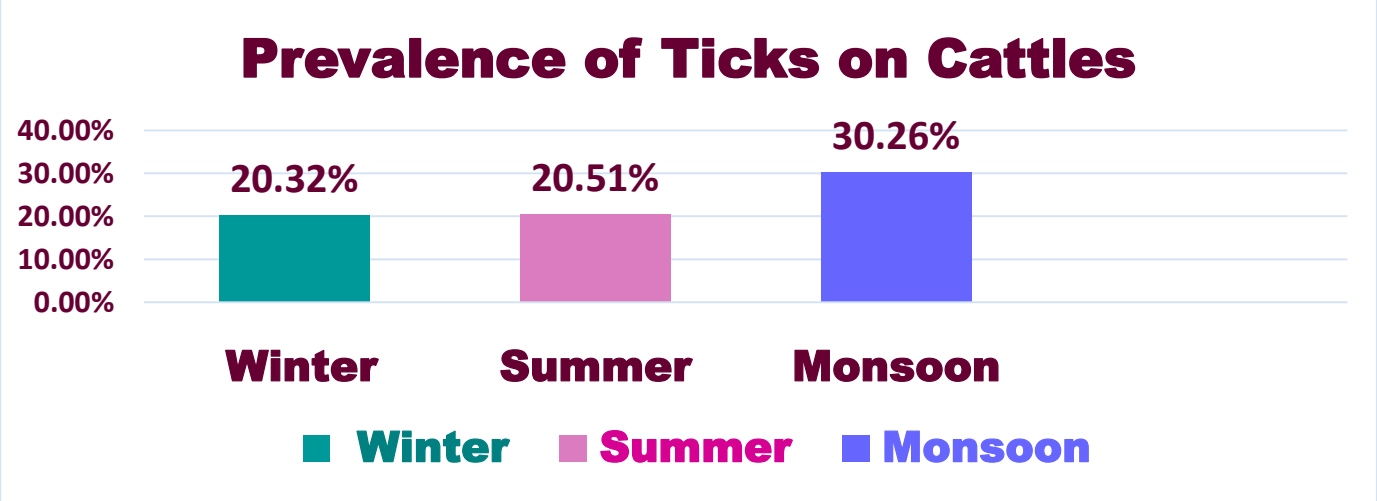
Result and Conclusion

This research provides valuable information on the dynamics of infestation in cattle and buffaloes over different seasons and emphasizes some notable differences in prevalence among species and seasons. An increased infestation rate noted in buffaloes, especially during the monsoon, might be due to factors like their coat color, which could improve their ability to hide and enhance tick survival.

However, the infestation in cattle was relatively lower, but the Red Khandari breed showed the highest infestation during winter, whereas the infestation in the Sahiwal breed was low in all seasons. The infestation findings highlight the importance of seasonal differences in tick prevalence and point out the need for targeted management tactics to control tick populations in both cattle and buffaloes.

Table 1. Prevalence of Ticks of Cattle (2024)

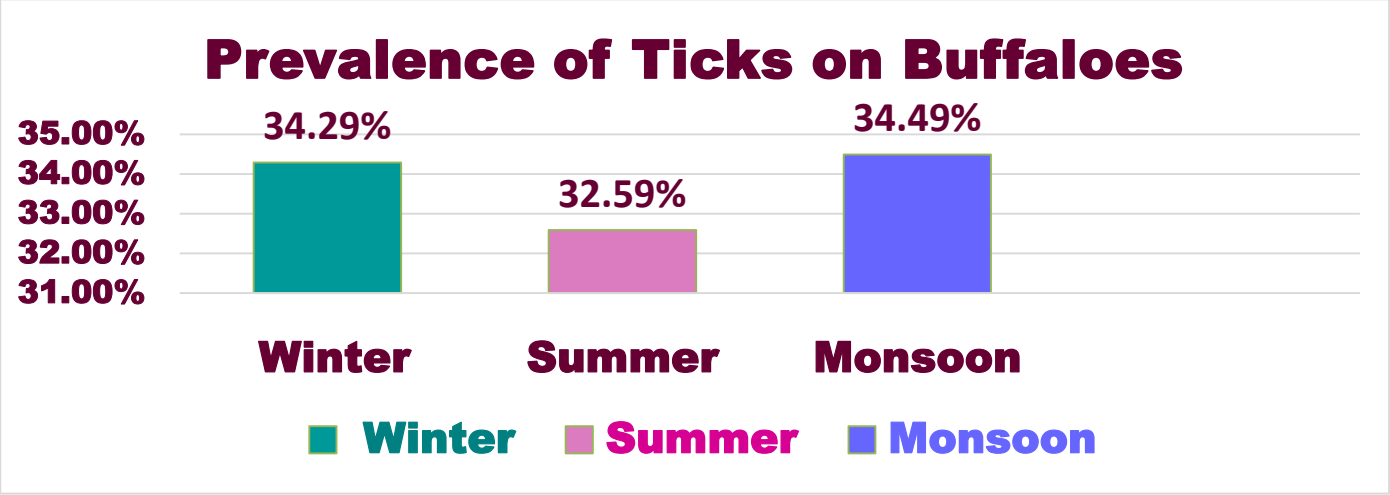
Seasons	Total Cattle Surveyed				Infested Cattle				Total Prevalence of Cattle
	Red Khandari	Gyr	Sahiwal	Halikar	Red Khandari	Gyr	Sahiwal	Halikar	
Winter	105	84	27	30	27	13	3	7	20.32%
Summer	117	93	21	42	31	17	3	5	20.51%
Monsoon	89	78	29	32	37	21	7	4	30.26%



Graph 1. Prevalence of Ticks of Cattle (2024)

Table 2. Prevalence of Ticks of Buffaloes (2024)

Month	Total Buffaloes Surveyed			Infested Buffaloes			Total Prevalence of Buffaloes
	Murrah	Jaffery	Gujjar	Murrah	Jaffery	Gujjar	
Winter	120	79	43	37	25	21	34.29%
Summer	91	57	33	29	17	13	32.59%
Monsoon	113	69	47	37	23	19	34.49%



Graph 2. Prevalence of Ticks of Cattle (2024)

The results further emphasize the importance of *Rhipicephalus species*, particularly *Rhipicephalus microplus*, *Rhipicephalus annulatus*, *Rhipicephalus decoloratus*, *Rhipicephalus sanguineus*, and *Haemophysalis longicornis*, as major ectoparasites that play a role in the transmission of economically crucial diseases like babesiosis and anaplasmosis.

The study also stresses the importance of immediate accurate species identification, based on morphological and ecological characteristics, to develop effective control measures. The specific morphological features, such as the particular posterior projection of male ticks, serve as crucial diagnostic features for differentiating between closely-related species, thus ensuring accurate species identification for field and laboratory studies. In a nutshell, the results advance the knowledge of the pattern of tick infestation in livestock, providing a foundation for more effective tick control measures, disease management efforts, and further study on the ecological factors that affect the population of ticks and their impacts on the health of livestock.

Declaration

I am Afreen Fatema R. K, and I am a research scholar at Zoology Department of N.E.S. Science College, Nanded. I am working under the guidance of Dr. Vidya V. Bhoyar. I declare that the data in this manuscript is original and not copied from elsewhere.

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