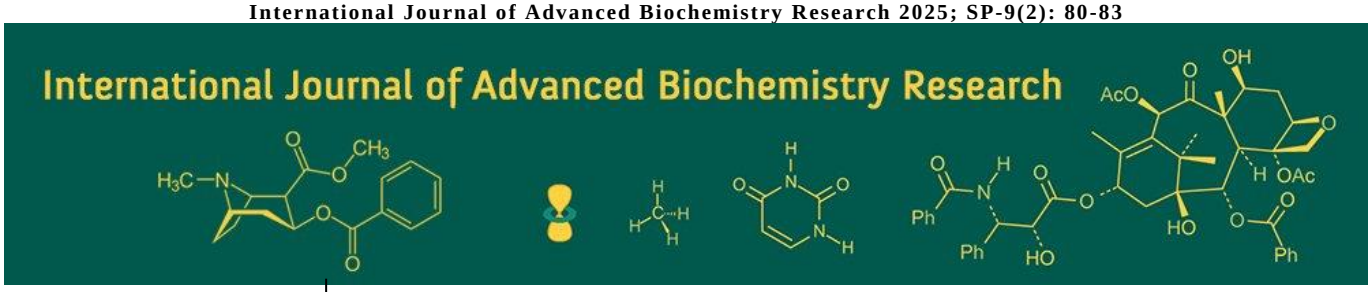

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Prevalence of ixodid ticks infesting cattle in Nagpur district of Maharashtra state

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Abstract
Tick and tick-borne diseases affects the health status of animals and ultimately lead to economic losses. The present study was conducted to determine the most prevalent tick species infesting cattle and to assess the season wise prevalence of ixodid ticks in Nagpur district of Maharashtra state. To study the prevalence of ticks in cattle, a total of 708 animals were examined from five talukas of Nagpur district of which 466 animals were found to be infested with ticks showing an overall prevalence of 65.81%. In season-wise prevalence the highest prevalence of ixodid ticks was found in post monsoon season (75.46%), followed by monsoon season (72.83%), summer season (62.24%) and lowest in winter season (55.08%). For species wise prevalence, a total of 3498 ticks were collected from the body of animals of which 2034 ticks were of *Rhipicephalus* spp. with a percent infestation of 58.15% and 1464 ticks were of *Hyalomma* spp. with percent infestation of 41.85%. *Rhipicephalus* spp. was the most prevalent tick species infesting cattle in Nagpur district of Maharashtra state. The high prevalence of ixodid ticks throughout the year indicates that the tropical climatic conditions in Nagpur district of Maharashtra favour the growth and survivability of ticks.

Keywords: Prevalence, ticks, cattle, species, season, Nagpur

Introduction
Cattle are the backbone of the dairy industry contributing 192.49 million population in India (20th Livestock Census). Despite the vast contribution of livestock to the Indian economy, the production losses are more due to various diseases (Manjunathachar *et al.* 2014) [16]. Parasites and parasitic diseases affect livestock production by decreasing the growth rate of animals ultimately responsible for reduced rates of reproduction and production yield and also altering the quality of milk and meat (Sharma *et al.* 2016) [25].
Ectoparasitic infestation in cattle are responsible for the production losses in livestock sector. Amongst the external parasites ticks infest almost 80% of the cattle population in the world (Benavides *et al.* 2000) [4]. The overall prevalence of tick infestation in cattle in India was reported as 53 percent (Singh *et al.* 2022) [27]. Tick infestation is responsible for economic losses through its direct effects *viz.* tick worry, tick toxicity, sucking of blood, irritancies, damage to hides and weight loss and indirect effects *viz.* transmission of tick-borne diseases, theileriosis, babesiosis, and anaplasmosis (Sahara *et al.* 2019; Singh *et al.* 2022) [23, 27]. Tick-borne diseases ranked in fourth position in major infections of livestock (Ghosh *et al.* 2007) [9]. Economic losses due to tick-transmitted diseases and expenses on control of ticks reduce the cost-effectiveness of animal production. The present study was conducted to generate the baseline data on the prevalence of different tick species infesting cattle and season-wise prevalence of ixodid ticks in cattle in Nagpur district of Maharashtra state.

Materials and Methods
Area of study
To study the prevalence of ixodid ticks, the ticks were collected from five taluka *viz.* Nagpur, Kamptee, Ramtek, Kalmeshwar and Umred of Nagpur district of Maharashtra state with a distance of about 50 to 80 km in each taluka.

Collection of ticks
The collection of ticks was done from organized and unorganized farms in four seasons;

Summer (March to May), Monsoon (June to September), Post-monsoon (October and November) and Winter (December to February) during January - December 2023. Ticks were collected from the body of cattle with precautions to preserve their mouth parts and appendages for morphological studies. Ticks were also collected from the ground, cracks and crevices of cattle shed in sample collection bottles. In summer season to maintain moisture, additionally, sterilized sand was kept at the bottom of bottles and a few drops of water sprinkled on it. Ticks were transported to the Department of Veterinary Parasitology, Nagpur Veterinary College for further studies.

Identification of ixodid tick species

The species wise identification of ticks was carried out by preparation of permanent mounts by following the protocol as described by Anish *et al*. (2020) [1] with some modifications by killing the ticks in Boardman's solution for 8-10 hours. The identification of ticks was done based on morphological keys described by Soulsby (1982) [29] and Walker *et al*., (2013) [32] by observing ticks under a zoom stereoscopic microscope.

Statistical analysis

The data of the prevalence study was assessed by applying Karl Pearson's Chi-square test of independent variables with a 5% level of significance $p<0.05$ and 1% level of significance $p< 0.1$.

Results and Discussion

Season wise prevalence of ixodid ticks in Nagpur district of Maharashtra state

To assess the season wise prevalence of ticks, total of 708 cattle were screened of which 466 cattle were found to be infested with ixodid ticks during January 2023 - December 2023 showing an overall prevalence of 65.81%. Tick infestation in post monsoon season was 75.46%, in monsoon season was 72.83%, in summer season was 62.24% and in winter season was observed as 62.24%. The highest prevalence of ixodid ticks was noted in post monsoon season followed by monsoon, summer and lowest in winter season in Nagpur district of Maharashtra state. Significant variation was recorded between the prevalence of ticks and various seasons from the Nagpur district of Maharashtra at 0.05 and 0.1 level of significance. No statistically significant difference of tick prevalence between monsoon and post monsoon season was observed. (Table 1).

Species-wise prevalence of ixodid ticks in Nagpur district of Maharashtra State

A total of 3498 ticks were collected to assess the species wise prevalence of ixodid ticks in cattle of which 2034 ticks were morphologically identified as *Rhipicephalus* spp. with the percent infestation of 58.15% whereas 1464 ticks were identified as *Hyalomma* spp. with the percent infestation of 41.85%. From Nagpur taluka 50.58% ticks were identified as *Rhipicephalus* spp. and 49.42% ticks were identified as *Hyalomma* spp. The percent prevalence of *Rhipicephalus* spp. and *Hyalomma* spp. in Kamptee taluka was 54.02% and 45.98% respectively. In Ramtek taluka, 64.79% ticks were belonging to *Rhipicephalus* spp. however 35.21% ticks were identified as *Hyalomma* spp. Kalmeshwar taluka showed 52.45% infestation of *Rhipicephalus* spp. and 47.55% infestation of *Hyalomma* spp. From Umred taluka, the rate of infestation of *Rhipicephalus* spp. and *Hyalomma* spp. was noted as 66.33% and 33.67% respectively (Table 2). *Rhipicephalus* spp and *Hyalomma* spp. were the tick species predominantly found to infest the cattle in Nagpur district of Maharashtra State.

Discussion

Many reports on prevalence of ticks in cattle are available in India as well as from abroad. Reviewing of recent literature on prevalence of ixodid ticks in India, Raote (1983) [21]; Shahardhar *et al.* (1988) [24]; Chavhan *et al.* (2013) [6]; Tambe (2014) [30], Thakur *et al* (2017) [31] and Bharkad (2019) [5] reported tick infestation in cattle with a range of 31.79% to 83.10% from various region of Maharashtra state. Patel *et al.* (2013) [19] from Mathura; Singh and Rath, (2013) [28] from Punjab; Mandloi *et al.* (2016) [15] from Indore, Madhya Pradesh; Ghosh *et al.* (2019) [10] from Mizoram; Negi and Arunachalam (2020) [18] from Uttarakhand and Jaliparthi *et al.* (2023) [13] from Telangana reported overall prevalence of ixodid tick as 60.07%, 58.06%, 58.87%, 63.39%, 66.32% and 63.4% respectively. Similarly, the research conducted in abroad by Rony *et al.* (2010) [22] and Asmaa *et al.* (2014) [2] reported the overall prevalence of ticks as 64.07% in Bangladesh and 60.05% in Egypt respectively. The highest prevalence of 86.15% and 82.41% of ticks was reported by Balasubramanian *et al.* (2019) [3] from Kerala and Anish *et al.* (2020) [1] from Andhra Pradesh respectively whereas the lowest prevalence of ixodid ticks of 35.82% was reported by Raote (1983) [21] in Maharashtra, 32.77% by Rajendran and Hafeez (2003) [20] in Andhra Pradesh, 22.40% by Shyma *et.al*. (2013) in Kerala and 25.53% by Bharkad (2019) [5]. In Maharashtra, *Rhipicephalus* spp. is most prevalent species reported by Raote (1983) [21]; Maske (1993) [17]; Jawale *et al.* (2012) [14]; Tambe (2014) [30] and Shahardhar (1988) [24]. Bharkad (2019) [5] reported the high prevalence of tick species as *Rhipicephalus* (*Boophilus) microplus* (18.08%), followed by *Hyalomma anatolicum* (5.97%), *Haemaphysalis bispinosa* (1.21%) and *Rhipicephalus haemaphysaloides* (0.27%). The reports of species-wise prevalence of ixodid ticks in present study are in agreement with reporting of research workers in Maharashtra state as well as reports of various states of India. Patel *et al.* (2013) [19] from Mathura; Dehuri *et al.* (2017) [8] from Odisha; Debbarma *et al.* (2018) [7] from West Bengal; Godara *et al.* (2018) [11] from Jammu region; Ghosh *et al.* (2019) [10] from Mizoram; Balasubramanian *et al.* (2019) [3] from Kerala and Anish *et al.* (2020) [1] from Andhra Pradesh reported *Rhipicephalus* spp. as a most prevalent species followed by *Hyalomma spp.* in cattle. However, the results of the present research work are in disagreement with some of the researchers study conducted in India. Jadhao *et al.* (2020) [12] reported the most prominently infested tick species as *Hyalomma anatolicum* (68.38%) followed by *Rhipicephalus microplus* (30.40%) in cattle in the plain region of Chhattisgarh state. The reports of these research workers showed a high prevalence of *Hyalomma* spp. which is not as per the results of the present study.

Table 1: Season wise prevalence of Ixodid ticks in Nagpur district of Maharashtra

Name of season	No. of animals examined	No. of animals positive	Prevalence (%)
Summer (March to May)	196	122	62.24
Monsoon (June to September)	162	118	72.83
Post-monsoon (October and November)	163	123	75.46
Winter (December to February)	187	103	55.08
Total	708	466	65.81
Chi-square test		20.90	S
Tab		5%-3.841	1%-6.635
P value		<0.005	<0.01

Table 2: Species-wise prevalence of Ixodid ticks from Nagpur district of Maharashtra State

Sr. No.	Name of Taluka	Species wise prevalence				
		No. of ticks collected	No. of *Rhipicephalus* spp.	% infestation	No. of *Hyalomma* spp.	% infestation
1.	Nagpur	601	304	50.58	297	49.42
2.	Kamptee	659	356	54.02	303	45.98
3.	Ramtek	744	482	64.79	262	35.21
4.	Kalmeshwar	713	374	52.45	339	47.55
5.	Umred	781	518	66.33	263	33.67
Total		3498	2034	58.15	1464	41.85
Chi-square test			62.86			
Tab.			5%-3.84		1%-6.63	
P value			<0.005		< 0.01	

Conclusion

The presence of ixodid ticks throughout the year, in the Nagpur district of Maharashtra state showed that the climatic conditions of Nagpur district are favourable for the growth, development and survivability of different life cycle stages of ticks. *Rhipicephalus* spp. is the most prevalent species in Nagpur district of Maharashtra, may be due to geographical variations, climatic changes and their adaptability. The baseline data obtained during the present study may help to implement the tick control policies in the area.

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