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Influence of Agro-climatic Factors on the Prevalence of Ixodid Ticks on Cattle in Telangana State, India

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ABSTRACT

Background: Ticks and tick borne diseases (TTBD) of cattle pose serious threats to the growth of dairy industry and cause a significant reduction in production. Impact of tick borne diseases on poor farming communities has been ranked very high. Considering the economic impact of tick infestation on livestock, the present epidemiological survey was undertaken.

Methods: A total of 8872 cattle were examined from three different agro-climatic zones *viz*. central (Khammam, Warangal), north (Nizamabad, Karimnagar), south (Mahaboobnagar, Rangareddy) to know the influence of Agro-climatic factors and season on the prevalence of Ixodid ticks on cattle in Telangana State, India from March 2019 to February 2020.

Result: An overall prevalence of 63.4% tick infestation was recorded in Telangana state out of which 78.05%, 71.3% and 51.9% of tick infestation was found in central, north and southern agro-climatic zones of Telangana, respectively. Among the six districts under study, highest prevalence was recorded in Khammam (79.7%) followed by Warangal (76.2%), Nizamabad (73.7%), Karimnagar (69.4%), Mahaboobnagar (55.8%) and Rangareddy (47.5%) districts. Seasonal influence showed significantly ($P \leq 0.05$) highest tick infestation in rainy season (71.9%), followed by summer (66.1%) and lowest in winter season (52.2%). The results of present investigation aid in planning yearlong tick controlling measures on cattle in Telangana state, India.

Key words: Agroclimatic, Cattle, Ixodid ticks, Prevalence.

INTRODUCTION

Livestock rearing is one of the most important economic activities in rural areas of the country, which accounts for about 27.2 and 4.1 per cent in agriculture and national GDP, respectively (Islam *et al*., 2016).

Cattle are the main source of animal protein apart from milk, providing meat, hides, draft power and their dung is used to increase soil fertility. India accounts for a significant share of worlds livestock resources nearly 16.5% of cattle, 16.3% goats and sheep 5.7%. Although India is ranking first in the total milk production, the tropical livestock productivity is quite low (Pino, 1981) because, of the neglected management and poor health of animals due to various factors including diseases as well as their transmitting agents (ectoparasites). Among ectoparasites, ixodid ticks are important blood-feeding parasites (Furman and Loomis, 1984).

Ticks either cause direct losses through tick worry, anaemia, reduction in live weight gain, dermatitis, low milk yield, down grading the quality of hides, producing toxins causing paralysis or indirectly through the transmission of various disease causative etiological agents. *viz*., *Theileriaannulata, T. buffeli, T. lestocardi (hirci), Babesia bigemina, B. motasi, Anaplasma marginale, Ehrlichia bovis* and *E. phagocytophila* (Ghosh *et al*., 2007). Both cattle and buffaloes are reared together, the number of ixodid species reported from cattle are significantly more (Ghosh *et al*., 2006). Annual global production losses due to tick and tick borne diseases was estimated as USD 22 billion (Lew-Tabor and Valle, 2016).

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Although species of ticks and tick borne diseases (TBDs) differ among ecological regions, their impact on cattle production depends on region, species involved, agents, host population, socioeconomic and technological advances adopted in control measures (Solis 1991). For an effective control measure, it is necessary to investigate various epidemiological factors, which determine the frequency and distribution of ticks. Incidence and prevalence of Ixodid ticks were reported earlier from different parts of the country *viz*. Gujarat, Haryana, Kerala, Maharashtra, Rajasthan, Punjab, Tamil Nadu, Uttarakhand, Uttar Pradesh and West Bengal (Sanyal and De, 2005; Kaur *et al*., 2015) except from Telangana, India.

MATERIALS AND METHODS

Study location

Telangana is a newly formed state in the Southern region of India spread over an areaof 114,840 km2 (44,300 sq. m) and situated between 16°-20°N latitude and 77°-82° E longitude (Table 1).

Study design

The cross sectional study was designed to investigate the distribution of ticks infesting cattle in Telangana state, where intensive agricultural and animal husbandryactivities are practiced. Cattle from six erstwhile districts of Telangana (Fig 1) were selected from 3 agro climatic zones along with season during the period from March 2019 to February 2020.

Some of the ticks were collected from representative cattle of each district with the help of blunt forceps and brush from different body parts of the cattle without damaging their mouth parts (Fig 2). After collection, the ticks containing vials were properly labelled with the details of zone, age, sex of the animal, date of collection *etc*. The ticks were brought to the Laboratory of Veterinary Parasitology, College of Veterinary Science, Rajendranagar in 70% alcohol (preservative) for identification using stereomicroscope. The identification was done by standard keys of Souls by (1982) and Walker *et al*. (2003).

Statistical analysis

The epidemiological data obtained from the study was analyzed by chi-square test in statistical software SPSS 16.0. The results with a greater number of proportions were analysed by Marascuilo test as described by Marascuilo and McSweeney (1967).

RESULTS AND DISCUSSION

The epidemiological studies indicated an overall prevalence of 63.4% (5625/8872) of tick infestation in Telangana state (Table 2).

Previous studies conducted indifferent parts of India reported an overall prevalence of tick infestation ranging from 22.4 to 68.2%. The high prevalence of tick infestation similar to the present study was reported from Punjab (58.06%), Lucknow (59.11%), West Bengal (41.93%), TamilNadu (68.2%) states of India by Singh and Rath (2013), Kaur *et al.* (2017), Debbarma *et al.* (2018) and Balasubramanian *et al.* (2019), respectively. The higher rate of tick prevalence in cattle of Telangana might be due to the climatic conditions that are highly conducive for the development and propagation of Ixodid ticks as evidenced by the meteriological data and also due to an increased rearing of cross bred cattle (Haque *et al*., 2011). In contrast to the present results, comparatively, a lower rate of prevalence was reported by Shyma *et al.* (2013) in cattle of Kerala (22.4%). The variation in the rate of prevalence of tick infestation in the study area and different parts of world could be due to the variation in geographical conditions of regions under study in addition to the other factors like host susceptibility, host density, grazing habits and managemental practices that influenced the distribution and propagation of ticks as opined by Aboma *et al*. (2017).

Zone wise prevalence of Ixodid ticks

A total of 8872 cattle were examined from three major agro-climatic zones of Telangana *viz*., central zone (Khammam and Warangal Districts), north zone (Karimnagar and Nizamabad Districts) and southern zone (Mahaboobnagar and Rangareddy Districts). Higher rate of tick infestation was found on cattle in central zone (78.05%) than northern zone (71.3%) and least in southern zone (51.9%) (Table 3). However, multiple proportions of Merascuilo test indicated significantly higher incidence in central zone and lowest in southern zone at a critical value of 5.9.

Higher prevalence recorded in central zone could be due to the typically tropical, rainy and somewhat humid climate and suitable ambient temperature. This zone receives an annual rainfall ranging from 1027 to 1032 mm and about 88.03% of total rainfall is received during south west monsoon only and humidity also reach 70-90%. Among the total land 40.6% were under irrigation which favours the growth of herb, shrub and grass and created a favourable sheltering place for ticks throughout the year as opined by

Table 1: Location and Rainfall statistics of Telangana state, India (16 years data , 2004 to 2020).

State	Zone	District	Latitude	Longitude	Mean annual rainfall (mm)	Meanmax-min temperature (centigrade)	Mean relative humidity (%)
Telangana	South	Mahaboobnagar	16°42′N	77°58′E	632	33.4-24.1	62-90
		Rangareddy	17°20′N	78°30′E	702	33.6-23.8	62-88
	Central	Khammam	17°15′N	80°11′E	1032	35-25	78-92
		Warangal	17°58′N	79°40′E	1027	34.3-24.8	68-93
	North	Karimnagar	18°28′N	79°06′E	871	34.2-24.5	64-92
		Nizamabad	18°40′N	78°10′E	990	34-24.3	64-90

Table 2: Overall prevalence of Ixodid ticks in cattle of Telangana.

Host	Total number of animals examined	Number of animals infested with ticks	Percentage
Cattle	8872	5625	63.4

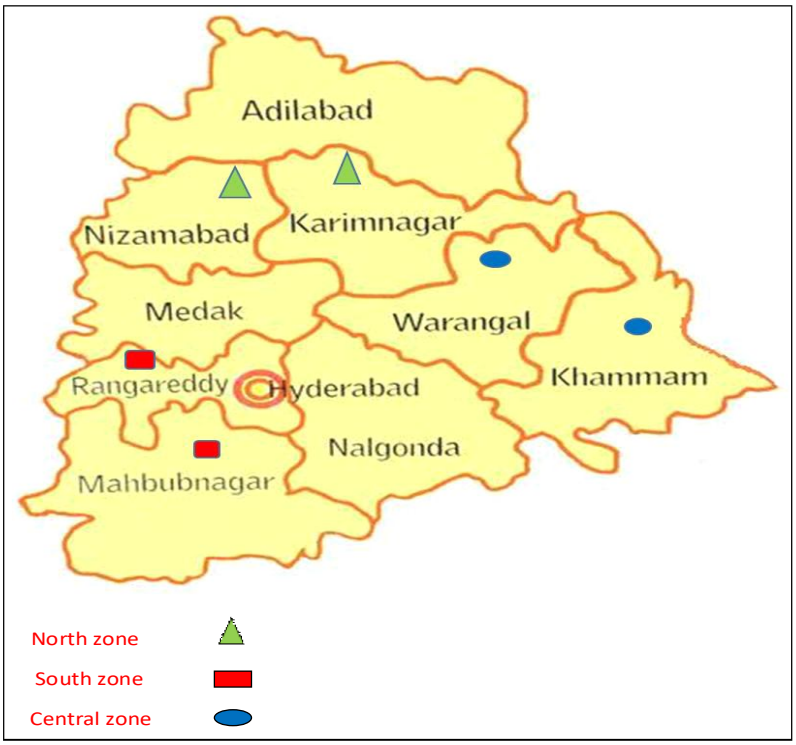

Fig 1: Telangana state map showing six erstwhile districts falling in three agroclimatic zones under study.

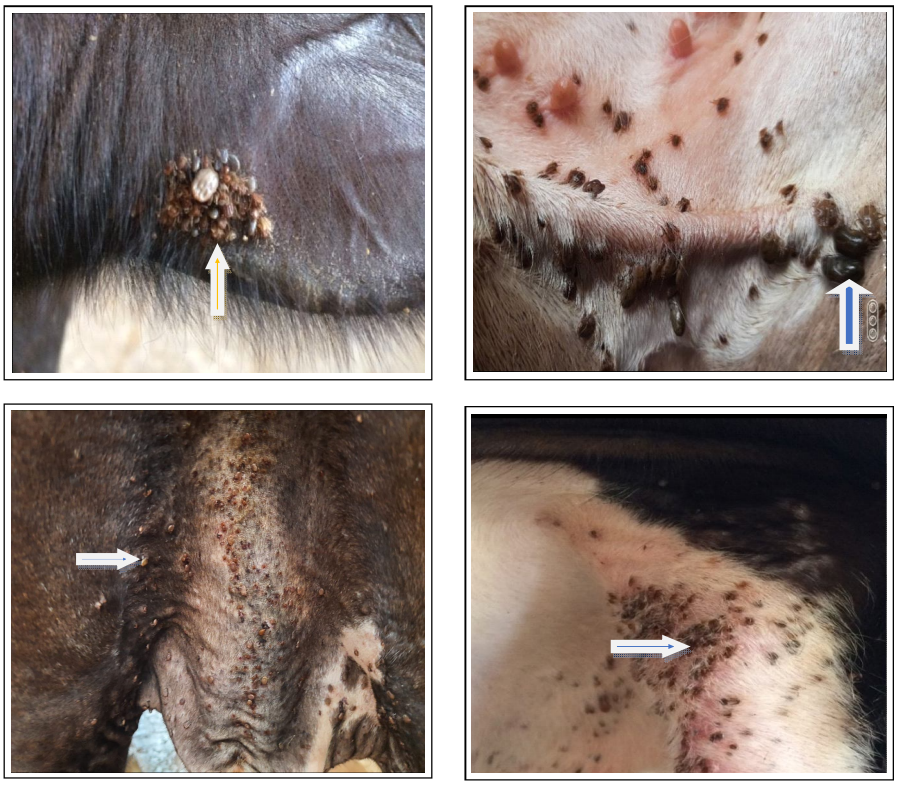

Fig 2: Photographs showing tick infested areas on different body parts of cattle.

MacLeod (1970). Whereas annual rainfall below 700 mm, dry and arid type of climate with red sandy soils and only 14% of the lands under irrigation without any forest cover, tree clad or vegetated areas in southern zone resulted in less humidity with resultant shrinkage of eggs, failure of hatching eggs lead to less prevalence of ticks compared to other two zones.

Though numerically the percent of tick infestation is higher in central zone it was not significantly (P≤0.05) comparable to northern zone. However, the tick infestation in central and northern zones were significantly (P≤0.05) higher than that of southern zone. The reason could be similar type of semi-arid climate in central and north zones compared to arid climate in southern zone. Similarly, Singh *et al.* (2013) recorded highest prevalence of tick infestation in sub mountain undulating plain region (98.4%) compared to that of other regions and established correlation between tick prevalence and annual rainfall and concluded a low tick prevalence with a decrease in annual rainfall. On contrary, Ghafar *et al.* (2020) reported higher tick prevalence in sandy desert than inirrigated plains.

District wise prevalence

Among the six districts of Telangana, the prevalence was significantly (P≤0.05) higher in Khammam (79.7%) followed by Warangal (76.2%), Nizamabad (73.7%), Karimnagar (69.4%), Mahaboobnagar (55.8%) and was minimum in Rangareddy (47.5%) districts (Table 3). Reason being the Khammam district was at high altitude, tribal zone and most of the land covered by forest and water bodies and Nizamabad district is situated at a considerable altitude from the sea-coast which holds suitable humidity (TSDPS and DES, 2021). The forests are mainly spread over the central part of both districts. These are Southern tropical dry deciduous forests and also help to render the climate more equitable for propagation of vectors. The cross bred population was also high in these districts which are more susceptible to tick infestation. Comparatively low prevalence of tick infestation in Karimnagar could be due to the improved husbandry practices followed in that area and awareness of farmers about their control.

In southern zone, the prevalence of tick infestation was high in Mahaboobnagar district (55.8%) compared to Rangareddy district (47.5%). Though rainfall in this area is scarce, the Krishna and Tungabhadra rivers were flowing through the southern Telangana are responsible for soil moisture in Mahaboobnagar leading to high prevalence. Rangareddy district located in the central part of Deccan plateau which is completely dry with arid type of climate and with less irrigated facilities showed comparatively less prevalence.

Season wise prevalence

Ticks from different districts of Telangana were collected throughout the year to understand the correlation between seasons and population dynamics of ticks. The study period was divided into three seasons *viz*. summer, monsoon and winter. The prevalence of tick infestation was significantly (p<0.05) higher in monsoon (71.91%) followed by summer (66.14%) and least in winter (52.21%). Multiple proportions of merascuilo test indicated significant (P<0.05) difference among the three seasons being highest in monsoon at a critical value of 5.9 (Table 4).

Ambient temperature and higher atmospheric humidity and microclimate of grazing lands in rainy season were more conducive for the feeding, growth, breeding, development and propagation of ticks (Ghai *et al*., 2008). The decreased prevalence of ticks in winter season could be due to their ability to protect themselves from adverse environmental conditions by entering into diapause leading to increased resistance to environmental extremes and reduced behavioural activity (Vatsya *et al*., 2007). Temperature, amount of bright sunshine hours, rainfall with relative humidity have been correlated either negatively or positively with questing behaviour of ticks leading to behavioural diapause involving temporary suppression of host seeking or attachment by unfed ticks (Belozerov, 1982). Ticks avoid questing at unfavourable times of the year, such as mid-summer when the temperature is too high and too low

Table 3: Zone wise prevalence of Ixodid ticks on cattle in Telangana State.

Zone	District	Number of cattle examined	Number of animals infested with ticks	Percentage of infestation
Central	Khammam	1134	904	79.72
	Warangal	1039	792	76.23
	Total	2173	1696	78.05[a]
Northern	Karimnagar	1255	871	69.40
	Nizamabad	1058	780	73.72
	Total	2313	1651	71.38[a]
Southern	Mahaboobnagar	2325	1298	55.83
	Rangareddy	2061	980	47.55
	Total	4386	2278	51.94[b]
	Grand total	8872	5625	63.4

*Superscripts with dissimilar alphabets indicate significant (P≤0.05) difference between values.

Table 4: Season wise prevalence ofixodid ticks on cattle in Telangana state.

Name of the district	Season									
	Summer			Rainy			Winter		Total	
	No. of cattle examined	No. of tick infested cattle	Percentage infested	No. of cattle examined	No. of tick infested cattle	Percentage infested	No. of cattle examined	No. of tick infested cattle	Percentage infested	No. of tick infested cattle	Percentage infested
Khammam	379	312	82.3	317	272	85.8	438	320	73.0	1134	904	79.7
Warangal	383	293	76.5	342	285	83.3	314	214	68.2	1039	792	76.2
Karimnagar	349	286	81.9	374	289	77.2	335	205	61.1	1058	780	73.7
Nizamabad	414	297	71.7	432	347	80.3	409	227	55.5	1255	871	69.4
Mahaboobnagar	810	436	53.8	743	518	69.7	772	344	44.6	2325	1298	55.8
Rangareddy	648	349	53.9	722	396	54.8	691	235	34.0	2061	980	47.5
Total	2983	1973	66.1[b]	2930	2107	71.9[a]	2959	1545	52.2[c]	8872	5625	63.4

humidity or winter. Ticks has the capacity to convert its body weight into egg mass at certain temperature and accordingly egg production was seized at below 10°C (Gray *et al.* 2016). Similar findings were made by Vatsya *et al* (2007). who reported significantly highest prevalence of ticks in monsoon (54.86%) when compared to summer (41.04%) and winter (23.93%) seasons and opined that, although the animals were infested with ticks thought the year, their numbers increased following rains indicating the rainfall as an important macroclimatic factor. The other authors like Debbarma *et al.* (2018), Singh *et al.* (2013) also reported high tick prevalence in rainy season followed by summer and least in winter.

CONCLUSION

The high level of tick infestation on cattle of Telangana state is suggestive of suitable environmental conditions for the propagation of ticks and tick born diseases and farmers should be advised to keep the animals under check at regular intervals and urgent need to develop strategic region specific schedule of tick control programmes.

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Disclosure statement

No potential conflict of interest was reported by any authors.

REFERENCES

Aboma, H., Kebede, A., Abdurahaman, M. (2017). Further studies on Bovine Ixodide Ticks in and around Bedelle, Southwest Ethiopia. African Journal of Agricultural Research. 12(22): 1922-1929.

Balasubramanian, R., Yadav, P.D., Sahina, S., Arathy Nadh, V. (2019). Distribution and prevalence of ticks on livestock population in endemic area of Kyasanur forest disease in Western Ghats of Kerala, South India. Journal of Parasitic Diseases. 43(2): 256-262.

Belozerov, V.N. (1982). Diapause and Biological Rhythms in Ticks. In: Physiology of Ticks. [F.D. Obenchain and R. Galun (Eds.)]. Pergamon Press, Oxford, pp. 469-500.

Debbarma, A., Pandit, S., Jas, R., Baidya, S., Mandal, SC., Jana, PS. (2018). Prevalence of hard tick infestations in cattle of West Bengal, India. Biological Rhythm Research. 49(5): 655-662.

Furman, D.P., Loomis, E.C. (1984). The ticks of California (Acari: Ixodida). Bulletin of the California Insect Survey. 25: 1-239.

Ghosh, S., Azhahianambi, P., Yadav, M.P. (2007). Upcoming and future strategies of tick control: A review. Journal of Vector Borne Diseases. 44(2): 79.

Ghai, J.K., Singh, M., Singh, A., (2008). Population dynamics of ixodid ticks infesting cattle in Bathinda and Hoshiarpur districts in the Punjab State. Annals of Biology. 24: 95- 100.

Ghafar, A., Gasser, R.B., Rashid, I., Ghafoor, A., Jabbar, A. (2020). Exploring the prevalence and diversity of bovine ticks in five agro-ecological zones of Pakistan using phonetic and genetic tools. Ticks and Tick-borne Diseases. 11(5): 101472.

Gray, J.S., Kahl, O., Lane, R.S., Levin, M.L., Tsao, J.I. (2016). Diapause in ticks of the medically important *Ixodes ricinus* species complex. Ticks and Tick-Borne Diseases. 7(5): 992-1003.

Haque, M., Jyoti Singh, N.K., Rath, S.S., Ghosh, S. (2011). Epidemiology and seasonal dynamics of Ixodid ticks of dairy animals of Punjab state, India. Indian Journal of Animal Sciences 81(7): 661-664.

Islam, M.M., Anjum, S., Modi, R.J., Wadhwani, K.N. (2016). Scenario of livestock and poultry in India and their contribution to national economy. International Journal of Science, Environment and Technology. 5(3): 956-65.

Kaur, D., Jaiswal, K., Mishra, S. (2017). Epidemiological study of ixodid ticks infesting cattle reared by small holder farmers. Journal of Entomology and Zoology Studies. 4(4): 284-291.

MacLeod, J. (1970). Tick infestation patterns in the Southern Province of Zambia. Bulletin of. Entomological Research. 60(2): 253-274.

Marascuilo, L.A. McSweeney, M. (1967). Nonparametric post hoc comparisons for trend. Psychological Bulletin. 67(6): 401.

Pino, J.A. (1981). The tropics and the world demand for animal protein. In: Diseases of Cattle in the Tropics, Springer, Dordrecht. 23-31.

Sanyal, A.K. De, S.K. (2005). Ticks (Acarina: Metastigmata) Fauna in the Thar Desert. Gaps in Research (eds. Ghosh, A.K. *et al.*). 81-87. The Scientific World Journal. 7(1): 1597-6343.

Shyma, K.P., Stanley, B., Ray, D.D., Ghosh, S. (2013). Prevalence of cattle and buffalo ticks in northern Kerala. Journal of Veterinary Parasitology. 27(1): 55-56.

Singh, N.K. Rath, S.S. (2013). Epidemiology of ixodid ticks in cattle population of various agro-climatic zones of Punjab, India. Asian Pacific Journal of Tropical Medicine. 6(12): 947-951.

Solis, S.S. (1991). *Boophilus* ticks ecology: Perspectives of a panorama. Proceedings of II international seminar on animal parasitology and tick-borne diseases, Morelos, Mexico. Pp 19-30.

Vatsya, S., Yadav, C.L., Kumar, R.R., Garg, R. (2007). Seasonal activity of *Boophilus microplus*on large ruminants at an organised livestock farm. Journal of Veterinary Parasitology. 21(2): 125-12.

Whether and climatology of Telangana state (TSDPS and DES) (2021). Government of Telangana, Hyderabad, Telangana, India.

Ghosh, S., Azhahianambi, P., De La Fuente, J. (2006). Control of ticks of ruminants, with special emphasis on livestock farming systems in India: Present and future possibilities for integrated control - A review. Experimental and Applied Acarology. 40(1): 49-66.

Lew-Tabor, A.E., Rodriguez Valle, M. (2015). A review of reverse vaccinology approaches for the development of vaccines against ticks and tick borne diseases. Ticks and Tick Borne Diseases. 7(4): 573-585.

Walker, A.R. (2003). Ticks of Domestic Animals in Africa: A guide to Identification of Species. Edinburgh: Bioscience Reports. Pp. 3-210.

Kaur, D., Jaiswal, K., Mishra, S. (2015). Studies on prevalence of ixodid ticks infesting cattle and their control by plant extracts. IOSR Journal of Pharmacy and Biological Sciences. 10(6): 01-11.