



Research Article

# Prevalence of Ixodid Ticks in Some States of the Country and its Public Health Importance

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## A B S T R A C T

Ticks are the obligate haematophagus ectoparasites of animals and also associated with human affliction since time immemorial. They are playing the role as reservoirs and vectors of many zoonotic pathogens, responsible for the occurrence of many emerging and re-emerging infectious diseases in recent times. Indian Tick Typhus is the first recorded tick-borne disease in the country and recently it is prevalent in many states of the country due to the ubiquitous presence of its vector tick *Rhipicephalus sanguineus* (Indian dog tick). Kyasanur Forest Disease (KFD) is the first discovered tick-borne arboviral disease in the country and transmitted by *Haemophysalis spinigera* and *H. turturis* are the major vector ticks, recently KFD is prevalent in seven districts of Karnataka state and from four neighbouring states also. Crimean-Congo Haemorrhagic Fever (CCHF), the dreaded disease is transmitted by *Hyalomma Spp.* ticks with high case fatality rate was first recorded in 2011 in Gujarat and it is also found reported from two adjoining states. In the present study ixodid ticks were collected from rural and urban areas of a few states of the country by NCDC, Bangalore team in which five genera of Ixodid ticks were recorded in the study viz., *Haemaphysalis*, *Rhipicephalus*, *Boophilus*, *Amblyomma* and *Hyalomma*. In view of recording of the important vectors of tick-borne diseases reported from various states of the country there is an urgent need to strengthen the surveillance and early diagnosis and control of tick-borne diseases in the country.

**Keywords:** Crimean Congo Haemorrhagic Fever, Indian Tick Typhus, Ixodid Tick Vectors, Kyasanur Forest Disease, Prevalence

## Introduction

Ticks are known for their human affliction since time immemorial, however the interest for their study was stimulated among scientists only during the second half of the 19<sup>th</sup> century when settlers in western United States died from Rocky Mountain Spotted Fever (RMSF) a tick-borne disease. Ticks and tick-borne diseases affect animal and

human health worldwide and are the cause of significant economic losses. In India until the discovery of KFD, a tick-borne arboviral disease in 1957, studies on tick-borne diseases received little attention.<sup>1</sup> India is predominantly an agricultural country with about 70% of its population is engaged in agriculture and farmers are keeping animals for milk, meat, wool, hide and for various farm operations. A total of 106 tick species have been reported from India, of



which a few of them are playing the role vectors of disease pathogens. The parasitic behaviour of ticks during their all life stages, excessive blood feeding on hosts, wide range of vertebrate host, high reproductive potential, long term survival and adaptability to harsh and variable ecological conditions are the important characteristics of ticks as potential vector of many disease pathogens.<sup>2</sup>

Ticks are highly specialized obligate haematophagous ecto parasites of mammals, birds and reptiles, distributed worldwide and are of enormous medical and veterinary importance owing to the direct damage they cause to their hosts and as a reservoir and vectors of a variety of zoonotic pathogens. Tick-borne infectious diseases are growing steadily, due to the establishment of the tick vectors in urban areas/ new areas and also posing serious threat to the world health problem.<sup>2</sup> In recent times, most of the emerging and re-emerging infectious diseases arise from zoonotic pathogens, and many of them are transmitted by tick vectors.<sup>2-4</sup> In the present study, ixodid ticks were collected from domestic animals, rodents and from the forest patches and ground from a few states of the country by NCDC Bangalore team. Ticks are identified and their prevalence and their probable role in the transmission of various tick-borne diseases affecting human are discussed.

## Materials and Methods

Ixodid ticks were collected from rural and urban areas of the study localities from various states by NCDC Bangalore team during the year 2015-16. Areas of tick collection are Wayanad (Kerala), Satari area in North Goa district (Goa), Gundalpet PHC area in Chamarajnagar district (Karnataka), Gudalur PHC area in Theni district (Tamilnadu), Sawantwadi PHC area in Sindhudurg district (Maharashtra), Barkot PHC area in Uttarkashi district (Uttarakhand), Mumbai Sea port area (MH) and Chennai Sea port area (TN). Ticks are collected either from the animal host bodies, or on the

ground or forest patches by flag dragging methods. However in the Mumbai and Chennai port areas from the rodents collected for plague surveillance work. Rodents trapped in wonder (wire cage) traps are examined for tick infestation, special attention was given to the ears, snout, limbs and axillary regions which are favourite site of attachment of ticks<sup>5</sup>. The tick specimens collected were preserved in 70% alcohol and transported to laboratory and identified by using standard keys.

## Results and Discussion

The particulars of collection of ticks made from various study areas of the country and tick species prevalence are summarised in the Table 1. Five genera of Ixodid ticks were recorded in the study. i.e. *Haemaphysalis*, *Rhipicephalus*, *Boophilus*, *Amblyomma* and *Hyalomma*.

The distribution and species prevalence of ticks are mainly governed by the proximity to forest, vegetation cover, climate and animal activity. Among the various study localities, Sindhudurg (Maharashtra) has recorded the prevalence of many tick species followed by Chamarajnagar (Karnataka) district. *Rhipicephalus sanguineus* is the most prevalent tick followed by *Boophilus Spp.* *Haemaphysalis Spp.* were commonly recorded from southern states of India. *Amblyomma* and *Hyalomma Spp.* are recorded from Sindhudurg (MH) and Chamarajnagar (KA) respectively. *R. sanguineus* is the only vector tick found in Mumbai and Chennai International sea ports which was collected as ectoparasites from the rodents trapped by using wire cages for routine surveillance. Since above tick collections were carried out on one to few occasions from the above study localities there are limitations for enumerating the total tick species prevalent in a locality. The public health importance of various tick species collected in relevance to transmission of tick-borne diseases prevalent in that state are discussed.

**Table 1. Distribution of Ixodid ticks collected from different localities (states) of the country during the study period of 2015-16**

Area	A	B	C	D	E	F	G	H	Total (sps.)
Wayanad, Kerala	+	+	-	-	-	-	-	+	3
Satari, Goa	+	+	-	-	-	-	-	+	3
Chamarajnagar, Karnataka	+	-	-	-	+	+	-	+	4
Theni, Tamil Nadu	-	+	-	+	+	-	-	-	3
Sindhudurg, Maharashtra	+	+	+	-	+	-	+	+	6
Barkot, Uttarakhand	-	-	-	-	+	-	-	+	2
Mumbai Sea Port, Maharashtra	-	-	-	-	+	-	-	-	1
Chennai Sea Port, Tamil Nadu	-	-	-	-	+	-	-	-	1
Total (Areas)	4	4	1	1	6	1	1	5	

A-*Haemaphysalis bispinosa*, B-*H. spinigera*, C-*H. turturis*, D-*H. intermedia*, E-*Rhipicephalus sanguineus*, F- *Hyalomma Spp.*, G - *Amblyomma Spp* and H-*Boophilus Spp.*

The dog tick, *R. sanguineus*, is the principal vector of Indian Tick Typhus (ITT) and it has been recorded from various parts of the country.<sup>5</sup> ITT a spotted fever is caused by *Rickettsia conorii* has been reported amongst residents of southern India by Mathai E et al.<sup>6</sup> The disease is reported from Maharashtra, Tamil Nadu, Karnataka, Kerala, Jammu and Kashmir, Uttarakhand, Himachal Pradesh, Rajasthan, Assam and West Bengal.<sup>7</sup> Indian Tick Typhus is the first recorded tick-borne disease in the country, mainly reported from forest and mountainous areas, however recently it is prevalent in many states of the country. This is attributed due to the ubiquitous presence of its vector *Rhipicephalus sanguineus* (Indian dog tick) in various localities of rural and urban areas.<sup>2,5,8</sup> However in the present study it has been recorded from rodents trapped by wounder traps from Mumbai and Chennai International seaport areas. Presence of ITT vector ticks in these points of entry (POE) is of public health importance which may favour the transmission and probable outbreaks of this disease.

*Boophilus* ticks are important pest of cattle and playing the role in the transmission of many pathogens of veterinary importance. It is known to transmit *Coxiella burneti*, *Theileria Spp.*, *Babesia Spp.* and *Borrelia Spp.* which are the very efficient vector of Bovine babesiasis caused by *Babesia bigemina* in India. It is also considered to be potential vector of *Rickettsia rickettsia* causing Rocky Mountain spotted fever (RMSF) in Brazil.<sup>8</sup> A number of viruses of unknown relationship to human or animal disease have also been isolated from this tick.<sup>2</sup>

Kyasanur Forest Disease (KFD) is caused by KFDV, a member of the family Flaviviridae and was identified in 1957 and isolated from a sick monkey from the Kyasanur forest in Karnataka state, India.<sup>9,10</sup> The disease is localized in seven districts of the state and occurs as seasonal outbreaks during December to May when the nymphal activity of the vector ticks in the forest is maximum. The two major vectors of KFD are *Haemaphysalis spinigera* and *H. turturis* besides these, other Ixodid species of *Haemaphysalis*, *Ixodes*, *Hyalomma*, *Dermacentor* and *Rhipicephalus* are capable of transmitting the pathogen. The main hosts of KFDV are small rodents, but shrews, bats and monkeys may also carry the virus and transmitted through the bite of an infected tick while the transmission to humans is through the bites of nymphs of ticks present in monkey death hot spots.<sup>11</sup> KFD infection in ticks and/or monkeys as well as sporadic cases in humans, have been reported from newer areas i.e. Chamarajanagar district in Karnataka, Nilgiri district in Tamil Nadu, Wayanad and Malappuram districts in Kerala, North Goa districts of Goa and Sindhudurg districts in Maharashtra and the affected areas are all part of the Western Ghats surrounded by forest and agricultural lands. People with occupational exposure to rural or outdoor settings (e.g., hunters, herders, forest workers, farmers) in these districts are potentially

at risk for infection if they come into contact with infected ticks.<sup>12-14</sup> More recently KFD is prevalent in seven districts of Karnataka state as well as from four neighbouring states sharing borders with the state. KFD newly reported areas constitute a number of diverse biotypes such as forest, cultivated clearings and grass lands. Clearing of the forest area for cultivation causes changes in tick fauna, and is considered as the temporary risk factor which resulted in the recent outbreaks of this disease. In the present study *H. spinigera*, *H. turturis* the primary vectors of KFD and *H. bispinosa* the secondary vector has been recorded from many states of the country suggest centripetal spreading and establishment of the disease.<sup>1</sup>

CCHF is a zoonotic viral disease caused by arbovirus belonging to the group *Nairovirus* and the disease has a wide distribution that correlates with the global distribution of *Hyalomma*, vector tick. CCHF was first identified in 1944 on the Crimean Peninsula in what was then Soviet Union. Later the Congo appellation was added in 1969 after the discovery of the same disease from central Africa in 1956. It is one of the severe forms of hemorrhagic fever endemic in Africa, Asia, Eastern Europe and the Middle East with a near fatal mortality rate and human to human infection is by nosocomical mode of transmission. It is not only an important public health threat but also has a significant effect on the healthcare personnel, especially in resource-poor countries. India was always under the potential threat of CCHF viral infection until an outbreak hit parts of Gujarat, in recent past.<sup>3,15</sup> However, the presence of CCHFV in India had been suspected, since it was detected in the neighbouring countries of Pakistan and western China, especially once CCHFV was first isolated from the tick species *Hyalomma anatolicum* and other Ixodid tick species in Pakistan.<sup>16</sup> However, in the past various workers have conducted serosurvey among animals and from South India showed CCHFV antibodies in many of the animal sera. *Amblyomma* ticks are the vectors of *Rickettsia rickettsi* and *R. conori* that cause RMSF in the United States and in South Africa respectively and certain species in tropical America attack men, wild and domestic animals and transmit serious diseases during their all stages of development.<sup>17</sup> Due to occurrence of many tick-borne diseases as emerging and re-emerging zoonotic diseases from various states of the country, it is an alarm for the future probable outbreak of similar dreaded diseases.

In general, as the incidence of tick-borne diseases has increased in many areas of the country, surveillance in other/ adjoining geographic areas should also be expanded. According to various recent study groups, India is considered a "hot spot" for emerging infectious disease, on a global map. In the recent years, vector-borne diseases have emerged as a serious public health problem in many countries of the South-East Asia, including India. Many

emerging zoonoses have spread globally at the human-animal interface and the risk factors for emergence reside in multiple sectors.<sup>2</sup> As such, India has extremes of climatological and geographical conditions, temperatures ranges from extremely low to high, temperate regions and desert, thick evergreen forest and areas of high rainfall. Increased population, urbanization, international travel, change in agricultural practices, environmental factors, change in lifestyle, deforestation, close contact of animals, and a porous international border make this country a high-risk area for outbreaks of emerging and new diseases.<sup>14,16</sup>

The study has clearly established the presence of potential tick vectors of Indian tick Typhus, KFD and CCHF in the areas surveyed and possible risk of infection. This emphasizes the need for active surveillance not only for existing pathogens in any geographic location but also for those that pose future threat and necessary preventive control measures need to be undertaken. Routine surveillance, early and prompt detection and deploying of appropriate disease specific control strategies and strengthening of existing health infra structure will pave the way for control of tick-borne diseases in the country on long term basis.

**Conflict of Interest:** None

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