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Correspondence

Difference in vector ticks dropping rhythm governs the epidemiology of Crimean-Congo haemorrhagic fever & Kyasanur forest disease in India

Sir,

Tick-borne pathogens are present in a large part of the world and cause significant global health concerns. Ticks serve as vector as well as reservoir for several bacterial, rickettsial and viral pathogens within enzootic life cycles. These pathogens have spread and expanded horizons due to agricultural activity and encroachment into unutilized lands thus increasing contacts between humans, domestic and wild animals. The increase in contact with ticks and other ectoparasites has resulted in the emergence of several important zoonotic pathogens including novel viruses[1].

India has two prominent tick-borne diseases namely, Crimean-Congo haemorrhagic fever (CCHF) and Kyasanur forest disease (KFD)[2-4]. Mortality rate of 30-50 per cent was observed associated with different CCHF outbreaks in India. However, morbidity associated with KFD was observed to be 2-20 per cent among different outbreaks[2-5]. CCHF is transmitted mainly by tick vector *Hyalomma anatolicum*, and apart from this by *H. marginatum marginatum*, *H. marginatum rufipes*, *H. marginatum turanicum* and *H. marginatum isaaci*. KFD is transmitted mainly by *Haemaphysalis spinigera*; in addition, other *Haemaphysalis* species such as *H. turturis*, *H. uana kinneari*, *H. minuta*, *H. cuspidata*, *H. bispinosa*, *H. kyasanurensis*, *H. wellingtoni* and *H. aculeate* are other known vectors for KFD[2,6-12]. Both the vector species are widely distributed in all geographical areas of India[2]. KFD is more localized in certain geographical areas, namely, five districts of Karnataka, Chamarajanagar, Nilgiri (Tamil Nadu), Wayanad and Malappuram (Kerala), Pali village (Goa) and recently confirmed in Sindhudurg, Maharashtra State[2,13], where it occurs in outbreak form, whereas only sporadic cases or import cases of CCHF virus (CCHFV) have been reported from Gujarat, Rajasthan and Uttar Pradesh[2]. Antibody survey in domestic animals has shown a wide prevalence of CCHF throughout the country[5].

Despite the high potential of virus transmission by these vector ticks that are distributed throughout the country, the incidences of these viruses are compartmentalized or restricted in geographic locations. Here, we report the behaviour of tick's dropping rhythm that governs the epidemiology of CCHF and KFD in India. Ticks of the genus *Haemaphysalis* and *Hyalomma* serve as vector as well as reservoir for KFD virus (KFDV) and CCHFV, respectively[2,14-17].

Numerous wild animals, birds and livestock serve as amplifying hosts for these viruses[2,14,15]. Transmission to humans occurs through bites of infected ticks or unprotected contact with infected animal/human. Human-to-human spread of CCHF cases occurs due to unprotected contact with infectious blood or body fluids. While human acquires KFD infection by the bites of infected *H. spinigera*, there is no evidence of human-to-human transmission.

Both KFD and CCHF vectors are two-host ticks and require two hosts to complete their life cycles. The adults lay eggs and emerging larvae attach to the vertebrate host. *Hyalomma anatolicum* parasitizes mainly cattle. The detachment and dropping rhythms of the species are so adjusted that these occur only at a time when the cattle is resting in the sheds normally at night time. The engorged ticks that drop in the sheds find suitable niche in the cracks and the crevices, where the female ticks oviposit and the larvae and the nymph moult to the next stage. The questing larvae, the unfed nymphs and adults that have moulted from the previous stage can easily find their hosts in the cattle sheds. The humans acquire infection when they come in close contact of this environment. Therefore,

only sporadic cases occur for CCHF though the virus is widely prevalent in various geographical areas.

The KFD incidences occur in persons entering the endemic forest areas, particularly the hotspots as the dropping of *Haemaphysalis* spp. ticks occur anywhere the animals move while grazing. Fed female ticks lay eggs, which hatch to larvae under the foliage. They further drop on vertebrates, particularly small mammals and feed on them. Subsequently, they mature to nymphs and drop from the host body. By this time, the attached larvae have moved to various distances travelling on the body of small mammals, generating larger focus of infected spots[2]. The nymphs climb to nearby shrubs and rest at the apex of leaves (Figure) and wait in search of vertebrate host[18]. As a result, monkeys and forest dwellers acquire KFD infections. On the contrary, CCHF vector *Hyalomma* spp. remains confined to resting shades of the animals[19] and accidental bites occur to human residing in close proximity to the animals, thus only sporadic cases occur.

KFDV is transmitted to the wild monkeys; the black-faced langur (*Presbytis entellus*) and the red-faced bonnet monkey (*Macaca radiata*) through bites of infected *H. spinigera* ticks. These are very susceptible animals like humans and succumb to the infections. Once death of animal occurs, the attached nymphs leave the body and spread around in search of a new host. This creates a hotspot of infection in the forest[20].

There are several differences in the bionomics of the two vector tick species, but this single behavioural difference of dropping rhythm governs the epidemiology of these two tick-borne diseases, namely, KFD and CCHF in India.

Understanding vectors and their bionomics must be taken on priority so that better interventions can be made to control such zoonotic infections. Increasing awareness among rural population and change in their behaviour for keeping animal sheds away from houses and taking anti-tick precautions would help in reducing the incidences of these diseases.

Figure. *Haemaphysalis spinigera* nymphal stage found on leaves.

***Conflicts of Interest*:** None.

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