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Prevalence and molecular detection of tick borne pathogens in goats and ticks from different parts of North Eastern regions of India

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ABSTRACT

Despite the fact that the climate of North-East (NE) India is suitable for tick diversity, no systematic study has been done regarding the prevalence of ticks and tick-borne pathogens affecting small ruminants. A total of 1053 goats belonging to different age groups, breeds, and sex were examined from April 2019 to March 2020. Blood smear examination and PCR assays were conducted to detect tick-borne pathogens in the collected samples. The tick species recorded were *Rhipicephalus (Boophilus) microplus, Hyalomma anatolicum anatolicum*, and *Haemaphysalis bispinosa*. The overall prevalence of tick-borne pathogens was 32.28%. Mixed infection with *Theileria* sp. and *Anaplasma* sp. was most common followed by single infections of Anaplasma sp. and Theileria sp. A significantly higher rate of infection was observed in female animals. Species-specific PCR revealed different tickborne pathogens like *Anaplasma marginale*, *Anaplasma centrale*, and *Theileria luwenshuni* in goats. Isolated DNA samples of ticks were found to be positive for *A. marginale*, *A. centrale*, and *T. luwenshuni* and *Coxiella burnetii* in three genera of ticks with PCR assay. The results showed that vector-borne intracellular haemoprotozoa and *Anaplasma* are prevalent in the study area in apparently healthy small ruminants and the identified ticks have an endosymbiotic relationship with *C. burnetii*.

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Introduction

Although small ruminants (mainly goats) play an important role in the economy in the North Eastern Hill region, several limiting factors come into play in the way of ensuring sustainable productivity and profitability of these animals. Parasitic diseases are one of the major problems adversely affecting the health and productivity of these animals (Patra et al. 2018).

Among ectoparasites, ticks are one of the most important and harmful blood-sucking arthropods of mammals, birds, and reptiles across the globe (Ghosh and Nagar 2014). The most important ixodid ticks for livestock in tropical regions belong to the genera *Rhipicephalus (Boophilus), Hyalomma, and Amblyomma*. The cross and exotic breeds of animals reared in India are highly susceptible to tick infestation and thereby tick-borne diseases too, whereas indigenous animals are somewhat resistant (Kumar et al. 2015). The diverse climatic zones of India are highly conducive for the survival and propagation of vectors and vector-borne pathogens (Bhattacharjee and Sarmah 2013; Laha et al. 2015). Tick-borne haemoprotozoan diseases are gaining momentum steadily because of the establishment of tick vectors in urban areas and are posing a serious threat to the world health problem (Rajput et al. 2005).

The most important intracellular haemoprotozoan disease transmitted by ticks to small ruminants is theileriosis caused by *Theileria*. The disease theileriosis is characterized by pyrexia, lymphoid hyperplasia, and digestive disorders, and associated pathology due to the destruction of erythrocytes. *Theileria hirci, T. luwenshuni* and *T. ovis* affect caprines and ovines, respectively, and are mainly transmitted by *Hyalomma* by means of trans-stadial transmission (Taylor et al. 2016).

Anaplasmosis, mainly caused by *A. marginale*, a rickettsial intraerythrocytic pathogen, is host-specific. It infects only ruminants and primarily cattle (Kocan et al. 2003). Other species causing anaplasmosis include *A. centrale, A. ovis*, and *A. bovis*. These rickettsial organisms are transmitted by biting flies and most tick species. The disease is characterized by fever and general depression, followed by weight loss, progressive anaemia, icterus, breathlessness, in the coordination of movements, abortion, and sometimes death (Minjauw and McLeod 2003; Kahn 2005).

Coxiella burnetti, the causative agent of Q fever in humans and coxiellosis in animals, was previously classified as *Rickettsia*, but now it belongs to the order Legionellales. It affects a wide variety of species including ruminants, companion animals, birds, and reptiles (Gangoliya et al. 2016). Among ruminants, goats are more severely infected with coxiellosis than sheep and cattle (Rodolakis 2006; Angelakis and Raoult 2011). Once a domestic ruminant becomes infected, the organism tends to concentrate in mammary glands, supra mammary lymph nodes, placenta, and uterus from which it may be shed in subsequent parturition and lactation (Gangoliya et al. 2016). Humans are also susceptible to *C. burnetti*. Although ticks are considered important in the transmission life cycle of *C. burnetii* in livestock, the primary means of transmission to humans is through inhalation of contaminated aerosol (Angelakis and Raoult 2010).

Keeping in view the importance of ticks and tick-borne pathogens in human and animal health, the aim of the present study was to investigate the occurrence of ticks and tick-borne pathogens in goats by means of visual inspection, blood smear examination, and PCR assay.

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