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Study of Prevalence of tick *Hyalomma excavatum* (Acari: Ixodidae) on *Bubalus bubalis* in Patan District, Gujarat state, India

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Abstract

The domestic water buffalo (*Bubalus bubalis*) primitively domesticated in Asia for milk and meat purpose but their health is highly compromised due to the infestation by ectoparasites so affected via vector borne disease agents. The present work was carried out to study prevalence of common tick *Hyalomma excavatum* parasitizing *B. Bubalis* population in Patan district, Gujarat state, India. The study was carried out from June 2019 to March 2020. In the present study, a total of 1595 *B. bubalis* (712 males, 883 females) were examined out of which 489 (30.66%) *B. bubalis* were tick infected while 1106 (69.34%) were free of tick. Infestation rate was very high in the female (28.15%) host individuals as compared to males (2.51%). Adult individual hosts showed high rate of infestation as compared to sub adults and calves. Maximum infestation of *H. excavatum* was observed around udders and anus in female and male individuals respectively. Present study reveals vital epidemiological information of *H. excavatum* infestation on *B. bubalis* population in Patan district which will be helpful in designing control and management policy for tick infestation.

Keywords: Ectoparasite Tick, Prevalence, Buffalo, Patan, Gujarat

1 Introduction

Ectoparasites are one of the major concerns of veterinary problems affecting the livestock industries in many parts of the world (Hourrigan, 1979; Colebrook and Wall, 2004). Out of all ectoparasites; lice, ticks and mites are the major transporters of certain pathogens (Loomis, 1986). Globally, the

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most common ectoparasites of mammals, birds and reptiles are ticks (Sonenshine, 1991; Razput et al., 2005). Ticks are classified under suborder Ixodida, order Acari and class Arachnida. Ixodida comprises approximately 851 species belonging to three families viz. Argasidae (soft tick), Ixodidae (hard tick) and Nuttalliellidae (Hopla et al., 1994). It has been found that about 80% of the world cattle population is infested by ticks (Bowman et al., 1996). Ticks are efficient vectors of pathogenic agents e.g., bacteria, protozoans and helminthes to human and animals next to mosquitoes (Jongejan and Uilenberg, 2004; Bars, 2009; Rony et al., 2010). Moreover, tick's infestation can decrease the quality of skin/hide up to 20-30% (Biswas, 2003) and also causes weakness, anaemia, immunologically more susceptible and decreased lactation in infested animals (Gwakisa et al., 2001).

Buffaloes were domesticated in Asia for milk and meat purpose and the phylogenetic records confirmed that buffalo originated approximately 4000-5000 years ago from China to India (Yang et al., 2008). India comprises largest livestock population which holds about 56.63% of the world's buffalo population (FAO, 2009). *B. bubalis* is the second largest source of milk for world and first for Asia (Khushk, 2005). The major hindrance in the growth of livestock population is ticks and tick-borne diseases (TTBDs) in tropical countries of the world including India (Biswas 2003; Minjauw and McLeod, 2003). In India, 109 species (12 Genera) of ticks were reported amongst which 36 species (9 Genera) have been observed to infest the livestock population of the North-Western states of India (Miranpuri, 1988; Geevarghese and Dhanda, 1995; Geevarghese et al., 1997; Barker and Murrell, 2004; Ahmed et al., 2007; Ghosh et al., 2007a, b). Most abundant tick species in India are *Rhipicephalus microplus*, *R. haemaphysaloides*, *Hyalomma anatolicum*, *Hyalomma excavatum* and *H. marginatum isacci* occurring throughout the nation (Ghosh et al., 2006). *Hyalomma* consists 30 species, majority of which require three-hosts for life cycle and are well-known vectors of protozoan diseases affecting livestock in India (Jongejan and Uilenberg, 2004; Bansal, 2005). There is a lacuna in the data regarding prevalence of the ectoparasites at the regional level in India (Chakravarti, 1985; Geevarghese and Dhanda, 1995; Biswas, 2003; Vatsya et al., 2008; Zade et al., 2012). In the northern region of Gujarat, it was observed that the infestation of *H. excavatum* was very common. Therefore, the present study was carried out to understand the prevalence of ectoparasite *H. excavatum* on population of *B. bubalis* in Patan district, Gujarat state, India.

2 Materials and Methods

The present study was conducted in 20 villages viz. Amajpara, Aminpura, Anavada, Bakaratpura, Gaja, Ganget, Golapur, Ishlampura, Keshani, Khalipur, Khalkshapir, Laxmipura, Mitha dharva, Patan city, Rabaripura, Rampura, Ranuj, Rotarynagar, Sankhari, and Sojintra of Patan district, Gujarat, India (Fig. 1) from June 2019 to March 2020. Villages were selected on the basis of dependency of the locals on the livestock and high population of *B. bubalis* as compared to other villages of district.

All individuals of *B. bubalis* were examined for the infestation of *H. excavatum* (Fig. 2). Sex and age of each individual of *B. bubalis* was recorded. Age of the individual was recorded on the basis of information provided bythe owner. On the basis of data collected on age of individuals, they were categorized as calves (<2 years), sub-adults (2-4 years) and adults (>4 years). Different body parts of infected individual were scanned thoroughly to collect the specimens of *H. excavatum*. The specimens of *H. excavatum* were picked using forceps to prevent de-capitulation and they were preserved in separate vials using 10% formalin (Soulsby, 2006). Total number of individuals of *H.*

excavatum collected from different body parts of an individual of *B. bubalis* was recorded in the data sheet. All the specimens were examined under stereomicroscope to confirm the identification (Abbasi et al., 2017; Walker, 2003). The mean variation of infestation of *H. excavatum* on different body parts of male and female was checked using one-way ANOVA.

3 Results

In the present study, a total of 1595 individuals (712 males, 883 females) of *B. bubalis* were examined out of which, 489 (40 males, 449 females) individuals were found infested by *H. excavatum* while 1106 (672 males, 434 females) individuals were free from infestation. Amongst the infested individuals, maximum infestation of *H. excavatum* was observed in female as compared to male (Fig. 3). In case of age groups, maximum infestation of *H. excavatum* was recorded in adult individuals followed by calf and sub-adult (Fig. 4).

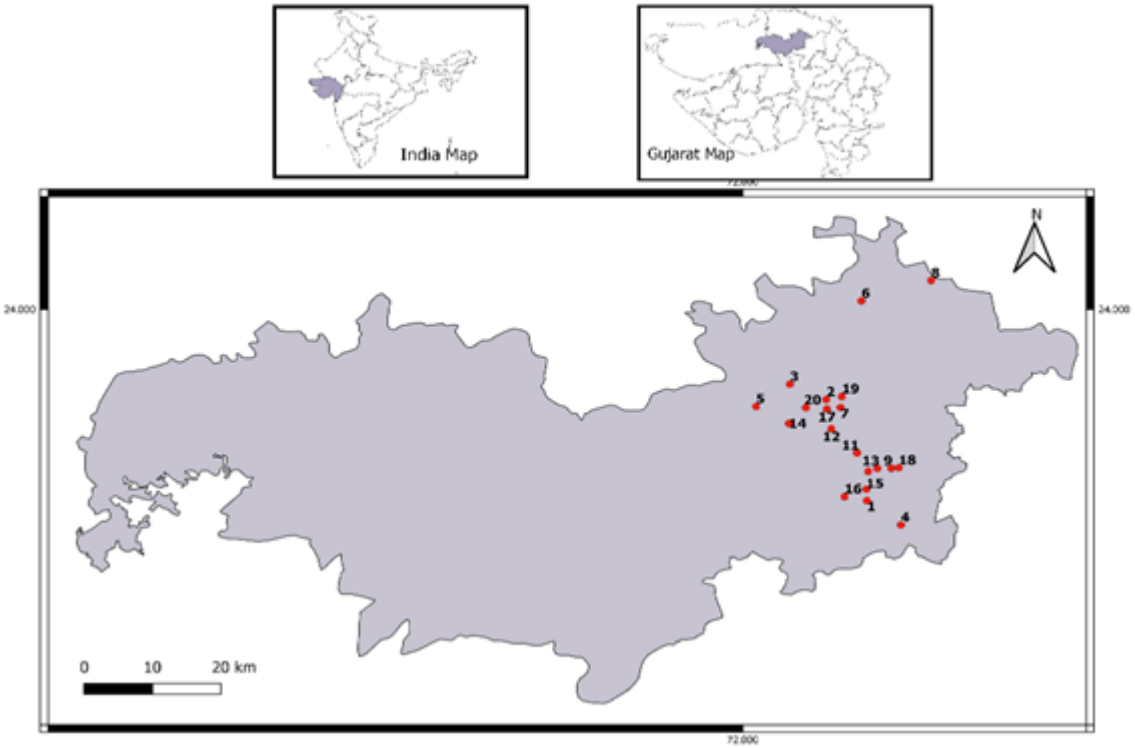

Figure 1. Study Site Map: India, Gujarat, Patan District: Villages: (1) Keshani, (2) Khalakshapir, (3) Khalipur, (4) Mitha dharva, (5) Rampura, (6) Laxmipura, (7) Amajpara, (8) Rabaripura, (9) Aminpura, (10) Sojintra, (11) Sankhari, (12) Golapur, (13) Islampura, (14) Barkatpura, (15) Ganget, (16) Gaja, (17) Patan, (18) Ranuj, (19) Rotarynagar, (20) Anavada respectively.

In females, maximum infestation of *H. excavatum* was recorded around udders followed by surface of legs, tail, neck, around anus, lateral sides of abdomen, ear, and head (Fig. 5). The mean variation in the percentage of infestation on different body parts of females varied significantly (ANOVA, $F= 968.2$; $P<0.0001$). In males, maximum infestation of *H. excavatum* was recorded around anus followed by tail, legs, ears, lateral side of abdomen, neck, and head (Fig. 6). The mean variation in percentage of infestation on different body parts of males varied significantly (ANOVA, $F= 24.49$; $P<0.0001$).

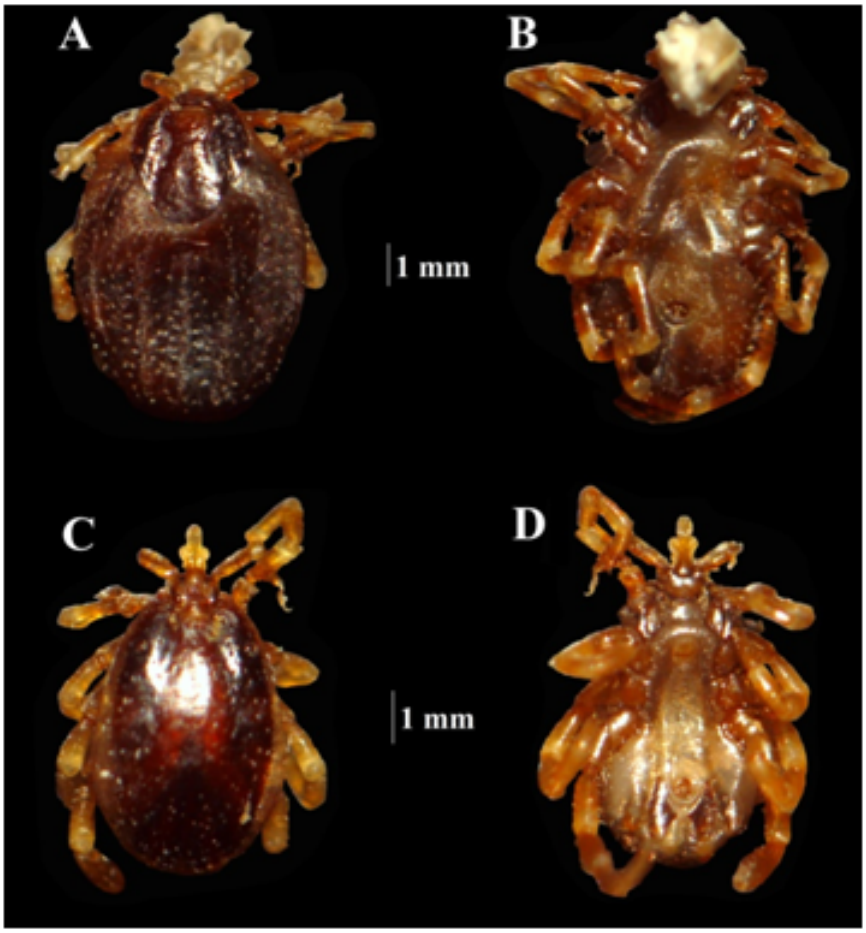

Figure 2. *Hyalomma excavatum*, A. female, dorsal view; B. female, ventral view; C. male, dorsal view; D. male, ventral view.

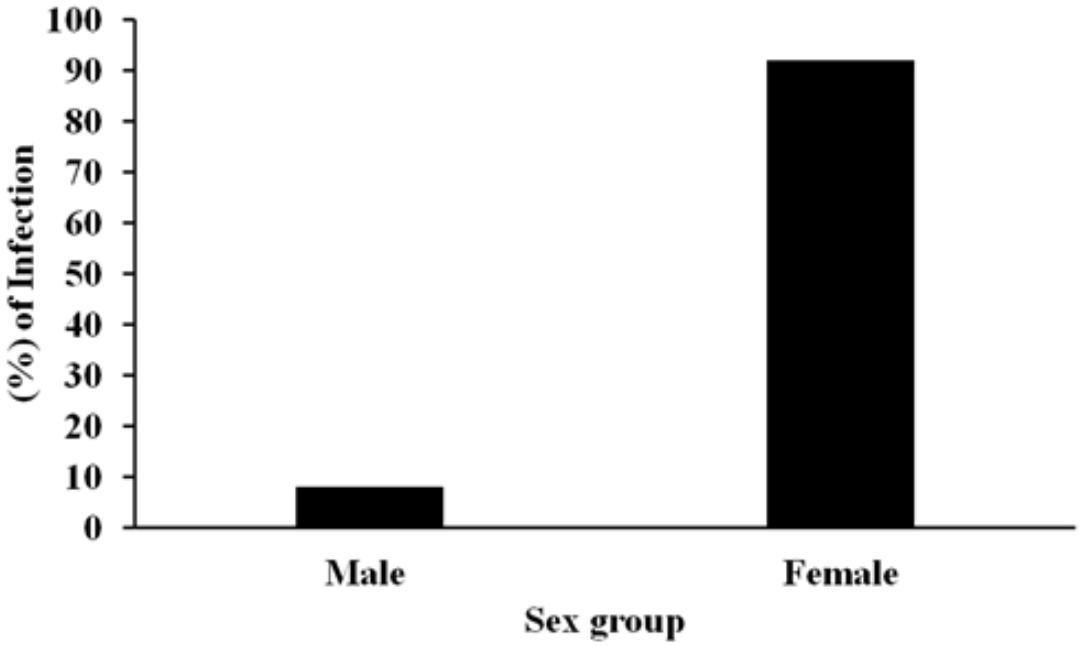

Figure 3. Prevalence of *Hyalomma excavatum* in male and female individuals of *Bubalus bubalis*.

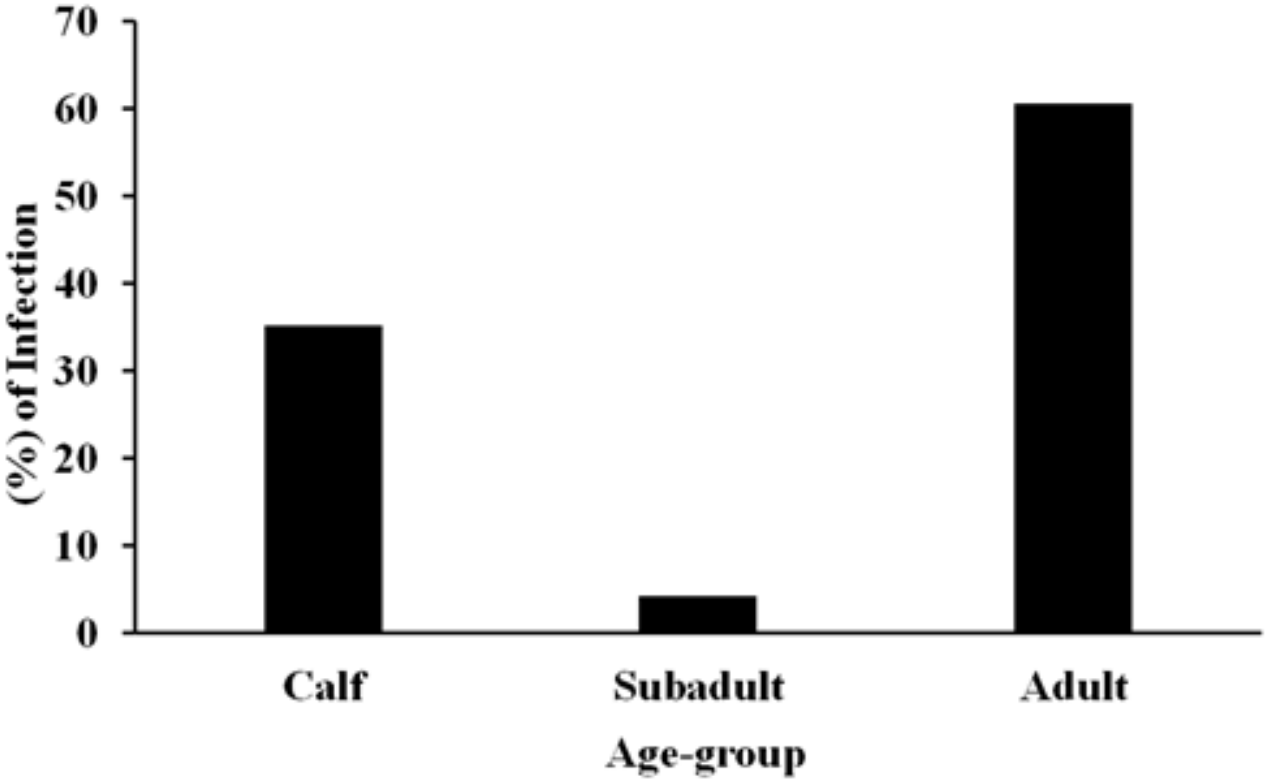

Figure 4. Prevalence of *Hyalomma excavatum* in the different age groups of individuals of *Bubalus bubalis*.

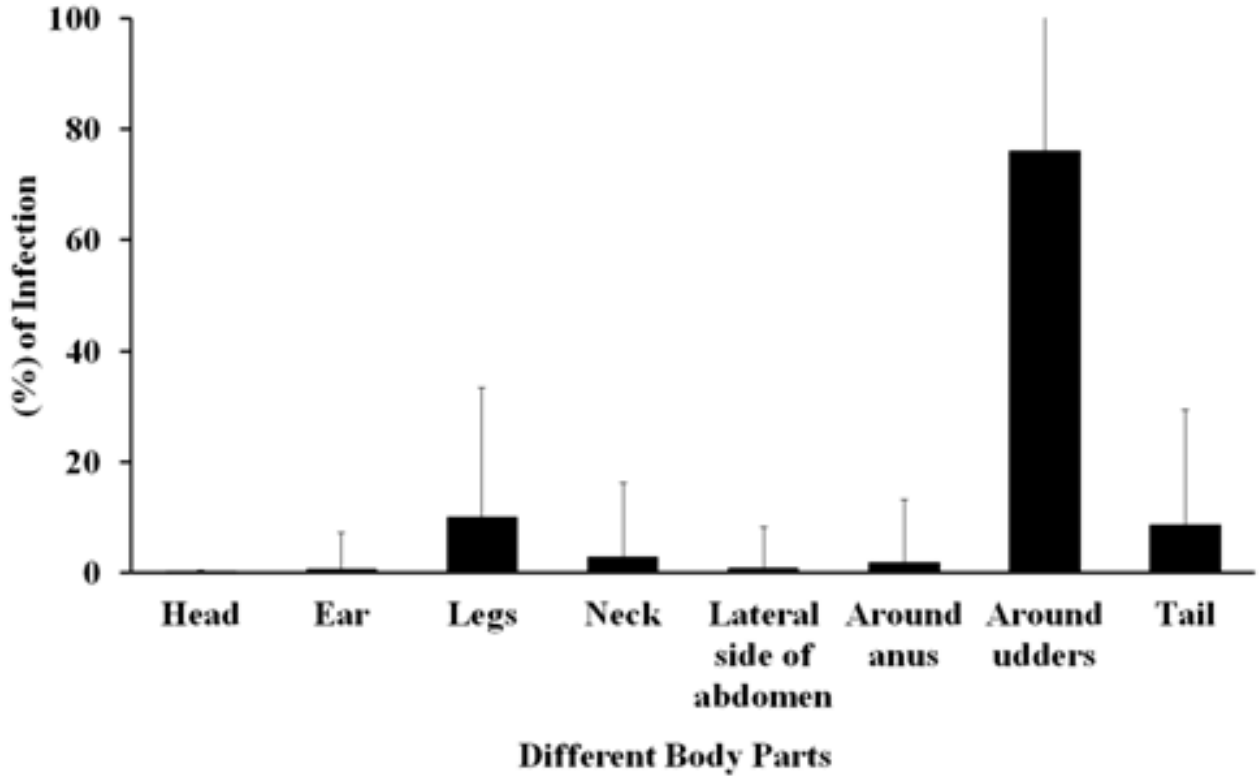

Figure 5. Prevalence of *Hyalomma excavatum* on different body parts of female individuals of *Bubalus bubalis*.

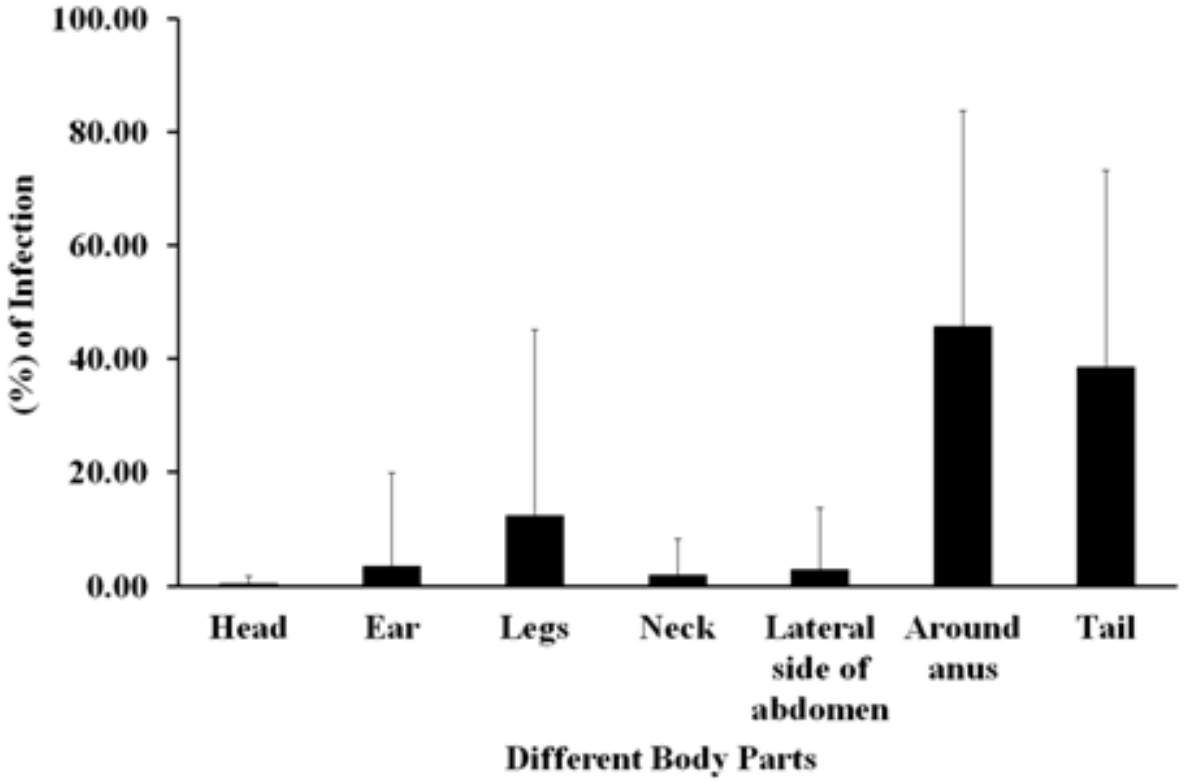

Figure 6. Prevalence of *Hyalomma excavatum* on different body parts of male individuals of *Bubalus bubalis*.

4 Discussion

Hyalomma excavatum was selected for the study as it is cosmopolitan and found abundantly in India and neighbouring countries. Previous study conducted in Iraq concluded that 4 out of 5 species belong to the genus *Hyalomma* were found infesting *B. Bubalis* (Shubber et al., 2013). This is because *Hyalomma* ticks are well adapted to live in arid biotopes of the old world (Shubber et al., 2013). Natala et al., (2009) reported that the survival rate of *H. excavatum* are higher than other tick species in high humidity and optimal temperature condition which are required to hatch eggs, resulting in the sudden upsurge in the population. In the present study, the overall prevalence of *H. excavatum* (30.66%) was slightly lower as compared to the prevalence of ectoparasitic tick species in other regions of India (Vatsya et al., 2007; Singh and Mishra, 2017). The variation in the rate of infestation of ticks in buffalo population can be attributed to the environmental conditions, geographic location and health care precautions taken by the animal holders (Ghosh et al., 2007a, b; Vatsya et al., 2008; Yacob et al., 2008a, b).

In the present study, it was observed that the rate of infestation of *H. excavatum* was very high in females (91.82%) as compared to the males (8.18%). Similar results were obtained in the studies carried out in Bangladesh (Rony et al., 2010; Kabir et al., 2011; Bilkis et al., 2007) and India (Singh and Mishra, 2017). Although the exact cause of higher infestation in female is not explained, it can be attributed that fluctuations in the level of hormones (prolactin and progesterone), pregnancy stress and lactation which makes female more susceptible to ectoparasite infestation (Lloyd, 1983; Kabir et al., 2011; Sutherst et al., 1983).

In case of age-wise infestation rate of *H. excavatum*, adults (60.54%) were having high rate of

infestation followed by calves (35.17%) and sub-adults (4.29%). Similar results were obtained in studies carried out in Bangladesh (Islam et al., 2009, Rony et al., 2010) and Ethiopia (Wasihun and Doda, 2013). This may be due to the strong innate immunity and age resistance of young animals which make them less vulnerable to tick infestation (Sarkar et al., 2010). The attachment sites of *H. excavatum* also showed significant variation among different body parts of *B. bubalis*. It was observed that the infestation of *H. excavatum* was higher in the posterior region as compared to the anterior region of *B. bubalis* body. Major infested regions were udders, legs, tail and around anus. Since the posterior region of the body has areas with short fur coat and soft skin, ectoparasitic infestation is more prevalent in this region as compared to the anterior region of the body (Al-Mayah and Hatem, 2018). In the present study, it was also observed that individuals of *B. bubalis* which were reared at farms (Rampura, Amajpara, Islampura, Amipura, Khalipur villages) were showing zero to low infestation rate of *H. excavatum* as compared to *B. bubalis* individuals of Keshani, Sojintra, Lakshmipura, Mithadharva, Sankhari, Ganget, Ranuj, Gaja, Golapur, Khalkshapir, Rabaripura, Patan city, Anavada, Barkatpura, and Rotarynagar villages which were released for grazing in open grazing fields. It is suggested that livestock released for grazing are more prone to infestation (Rony et al., 2010).

In a developing country like India where majority of population is dependent upon farming and dairy sector, higher infestation rate by ticks can cause a serious damage to domesticated animals and hence affecting the country's economy. The management of tick infestation in *B. bubalis* is a challenging task for the farmers and authorities. There is a lacuna of information regarding their prevalence in various parts of the country. The observations from the present study may contribute to the understanding of prevalence of *H. excavatum* on *B. bubalis* in Patan District. Further studies on tick prevalence are also required in other parts of Gujarat to clear the faded knowledge of tick distribution and infestation rate in *B. bubalis* and other livestock. It is required that more focus should be given on the diversity and distribution of ectoparasites on various breeds of livestock in a particular region which can help in direct efforts to control these parasites.

Conflict of interests

The authors declare that there are no competing interests.

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