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Prevalence of ixodid ticks in cattle population in Saurashtra region of Gujarat

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Abstract
To study the tick infestation and infectivity of tick with *Babesia* parasite, a total of 860 cattle were examined from more than 100 farms/Gaushala/Panjrapole of four districts namely Junagadh, Porbandar, Rajkot and Gir-Somnath of Saurashtra region of Gujarat where 46.05% cattle were found infested with ticks. The collected ticks were identified as either *Hyalomma* or *Rhipicephalus* (*Boophilus*). Only *Hyalomma* tick, only *Rhipicephalus* (*Boophilus*) and mixed tick (both tick) infestations were recorded as 48.23%, 29.04% and 22.73%, respectively on cattle. District wise, higher percentage of *Hyalomma* tick infestations was recorded compare to *Rhipicephalus* (*Boophilus*) except Junagadh where both were equal. But, the difference was statistically not significant except between Rajkot and Junagadh. The present research programme documented that about half of the cattle population of this region are infested with *Hyalomma* and/or *Rhipicephalus* (*Boophilus*) ticks. Where, certain percentage of *Rhipicephalus* (*Boophilus*) tick are infected with *B. bigemina*.

Keywords: *Babesia*, *Rhipicephalus* (*Boophilus*), Saurashtra-Gujarat

1. Introduction
Ticks were considered as parasites of domestic animals as early as 400 B.C. Aristotle in his famous *Historia animalium*, stated that the ticks were disgusting parasites generated from grass. Despite this early realization, little work was done until the latter half of nineteenth century, when a number of parasitologists all over the world started working on taxonomy, prevalence, and bionomics, seasonal and regional occurrence of the ticks (Dobbelarece and Heussler, 1999; Taylor *et al*., 2007) [4, 7].

Ixodid have a chitinous covering or scutum which extends over the whole dorsal surface of the male, but covers only a small area behind the head in the larva, nymph or female. The mouth parts carried on the capitulum are anterior and visible from the dorsal surface. Other distinguishing features are a series of grooves on the scutum and body, in some species, a row of notches, called festoons, on the posterior border of the body.

Chitinous plates are sometimes present on the ventral surface of the males. The genital opening is in the ventral mid-line and the anus is posterior. Some ticks have coloured enamel-like areas on the body and these are called 'ornate ticks'. The adults have a pair of spiracles behind the fourth pair of legs. Eyes, when present are situated on the outside margin of the scutum (Solomon and Kaaya, 1996; Nejash, 2016) [19, 14].

Ticks are important vectors for diseases like Babesiosis, Theileriosis, Anaplasmosis and Ehrlichiosis in domestic ruminants. They are known to exacerbate non-specific disease symptoms like anemia, toxicosis and paralysis (Bossena, and Abdu, 2012; Morka *et al*., 2014) [2, 13]. Approximately 80% of cattle population of the world are at risk of tick infestation and tick-borne diseases (Kahn, 2010) [10].

Babesiosis is an important tick-borne disease that is widespread in the tropical and subtropical countries. The disease is known to cause considerable economic losses indirectly in the form of reduced weight gains and milk production or directly through mortalities and veterinary costs. Successful management of babesiosis in dairy farms depends on increased knowledge of interactions between the parasites, vectors, climatic conditions and ruminant hosts. Little is known about the epidemiology of *Babesia bigemina* in smallholder dairy farming systems and the interaction of management factors and parasitism, is also poorly understood. The present study was conducted from July 2017- August 2018 to identify the *Babesia* parasite from tick population naturally infested the cattle of Junagadh, Rajkot, Gir-Somnath and Porbandar district of Saurashtra region of Gujarat.

2. Materials and Methodology

Research methodology contains the description of procedure with which experiment was carried out during and after experiment. It contains the location, year, season, experimental design, collection of samples, parameters to be studied and statistical analysis as describe below.

2.1 Location: The present study was conducted at Department of Veterinary Parasitology, College of Veterinary Science and Animal Husbandry, Junagadh Agricultural University, Junagadh, Gujarat (Longitude-21.52º N, Latitude-70.46º E).

2.2 Area under study: Junagadh, Rajkot, Gir-Somnath and Porbandar district of Saurashtra region of Gujarat.

2.3 Year and Season of Experiment: July 2017- September 2018.

2.4 Tick collection and transportation: Standard collection procedure was followed for the collection of tick sample from animals following biosafety measures. Randomly, ticks were collected from different cattle population of a farm/ gaushala/ panjrapore coming under area of study (Table 1). Animals were thoroughly examined for any tick infestations and tick stages such as male, female and were collected from animal body using forceps. Five to eight ticks collected from individual animal were pooled and called as one sample. During study period, 402 tick samples were collected and preserved in 70% ethanol.

Table 1: Details of ticks collected from cattle in the different districts of Saurashtra region of Gujarat

Region	District	No. of animals examined	Total Ticks Samples
South Saurashtra Region	Junagadh	298	148
	Porbandar	186	77
	Gir-Somnath	155	78
North Saurashtra Region	Rajkot	221	99
	Total:	860	402

2.5 Identification of tick

Collected ticks were identified under stereo-zoom microscope (Magnus Olympus Stereozoom Trinocular microscope, MSZ-Tr) based on morphology using standard identification key (Walker *et al*., 2003) [22]. Briefly, for genus level identification, consistent and unique key features of ticks were used (Table 2). Finally tick samples were stored in -20 °C. Tick collected from animals or shed were washed in water, wiped and stored.

Table 2: Key points for the identification of tick at genus level

Major tick genera	Main identification points
Hyalomma	Longirostrate, legs with pale ring at joint, Festoon present.
Rhipicephalus (*Boophilus*)	Brevirostrate, Festoon absent, Coxae 1 have small paired spurs.
Rhipicephalus	Brevirostrate, eye present, Hexagonal basis capitulum, Festoon present.
Haemaphysalis	Brevirostrate, Eye absent, Ventral plates are absent, Festoon present.
Dermacentor	Brevirostrate, Coxae 4th is very large compared to other, Ventral plates are absent, Festoon present.
Amblyomma	Longirostrate, ornate, somewhat oval in shape
Ixodes	Longirostrate, eye absent, Anterior anal grooves

2.6 Statistical Tools and Techniques

Collected data was compiled, tabulated and analysed using appropriate statistical tools and techniques in consultation with statistician in view the objectives of the study. Chi-square test was used to compare the tick infectivity data among organized farm, gaushala, and panjrapor and difference at $p \leq 0.05$ will be consider as significant (Pearson, K. 1990).

3. Experimental Results

3.1 Collection of tick from animals

Randomly, 42 private farms and 57 Gaushala and 8 Panjrapole were visited to collect the tick samples from cattle at different interval from four selected district of Gujarat. Varying degree of tick infestations were observed during external examination of animals. In majority of case, higher intensity of tick infestations was recorded from weak and young animals and where animal management was poor. Randomly, from individual farm two or three and from Gaushala and Panjrapole 8 to 10 tick samples were collected from individual animals. Both male and female ticks were collected. During study period about 396 such pooled tick samples were collected and brought to laboratory. The details of tick collection were presented in Table 3 and Fig 1.

This region of Gujarat is having rich population of Gir and Kankrej cattle. Gir as a milch and Kankrej as drought purpose breed. Though, both indigenous breeds are well known for its disease's resistance ability. But due to higher prevalence of tick vector (46.05%), as and when tick-borne diseases outbreaks in individual farms/ Gaushala were recorded. Short period of winter and highly humid and warm climatic condition (with an average temperature of 36-37 °C) of this region is highly suitable for the growth and development of TTBDs.

Table 3: Tick samples collected from different farms, Gaushala and Panjrapole.

District	Number of Farms/ Gaushala/Panjrapole	Number of Animals examined	Number of tick samples
Junagadh	37	298	148 (49.66%)
Porbandar	19	186	77 (41.40%)
Gir-Somnath	23	155	78 (50.32%)
Rajkot	28	221	93 (42.08%)
Total	107	860	396 (46.05%)

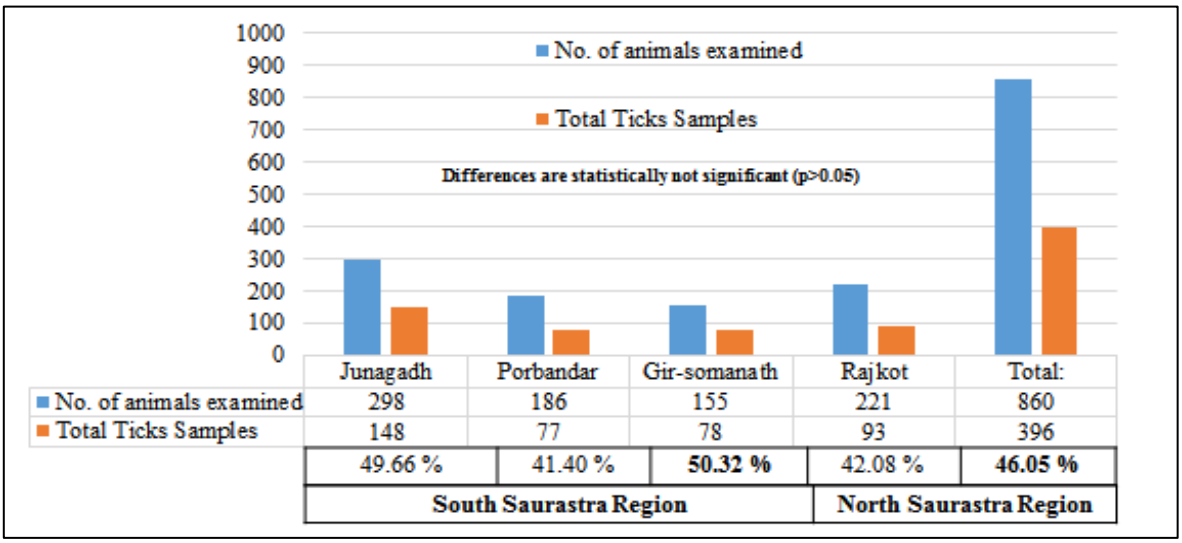


Fig 1: Details of ticks collected from cattle in the different districts of Saurashtra region of Gujarat

3.2 Identification of tick

After washing and killing, collected tick samples were examined under stereo-zoom microscope for identification. Individual ticks of each sample were thoroughly examined and identified first for genera and some of them up to species. Identification was mainly conducted at genus level. Morphologically, ticks were identified as either *Hyalomma* or *Rhipicephalus* (*Boophilus*). Randomly, few ticks were observed for its species. Amongst *Hyalomma*, *Hy. anatolicum* (Fig. 2(A)) was the major one but *Hy. dromedarii* (Fig. 3) was also identified. Amongst *Rhipicephalus* (*Boophilus*), *R.* (*B.*) *microplus* was only observed (Fig. 4). The pooled tick samples were identified as *Hyalomma*, *Rhipicephalus* (*Boophilus*) and mixed, if both are present. Among the total 396 pooled samples 191, 115 and 90 were found as *Hyalomma*, *Rhipicephalus* (*Boophilus*) and mixed, respectively. The details of ticks identified from pooled samples of individual animals from different district were given in Table 4 and Fig. 5.

Among the 106 tick species recorded from India on various animals, *Rhipicephalus* (*Boophilus*) and *Hyalomma* are the most common ticks of cattle. They were recorded from different states of India, including Gujarat (Ghosh *et al.*, 2007; Ghosh and Nagar, 2014) [7, 6]. In the present study higher infestations of *Hyalomma* ticks (48.23%) was registered followed by *Rhipicephalus* (*Boophilus*) (29.04%) and mixed (22.73%) (Table 4). District wise, higher percentage of *Hyalomma* tick infestations was recorded compare to *Rhipicephalus* (*Boophilus*) except Junagadh where both were equal. But, the difference was statistically not significant except between Rajkot and Junagadh ($p<0.05$; chi-square value= 7.9192).

Table 4: Species of tick identified from samples collected from cattle

District	Number of Samples	*Hyalomma* tick samples	*Rhipicephalus* (*Boophilus*) tick samples	Mixed tick of both genera
Junagadh	148	60 (40.54%)	60 (40.54%)	28 (18.92%)
Porbandar	77	39 (50.65%)	18 (23.38%)	20 (25.97%)
Gir-Somnath	78	37 (47.44%)	21 (26.92%)	20 (25.64%)
Rajkot	93	55* (59.14%)	16 (17.20%)	22 (23.66%)
Total	396	191 (48.23%)	115 (29.04%)	90 (22.73%)

$p<0.05$ between Junagadh and Rajkot

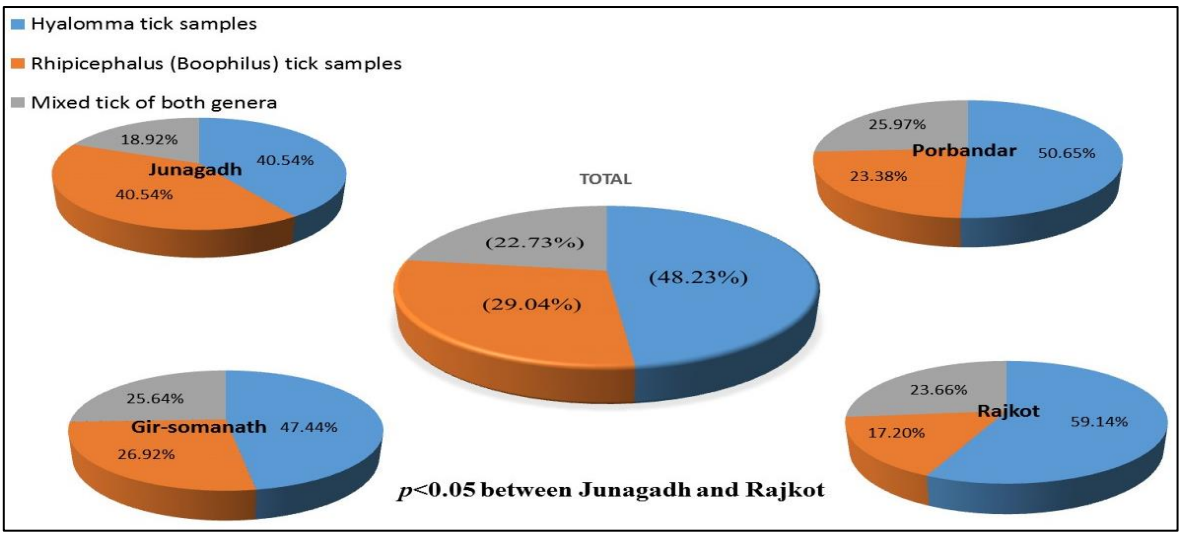


Fig 2: Percentage wise distribution of tick species in Saurashtra region of Gujarat

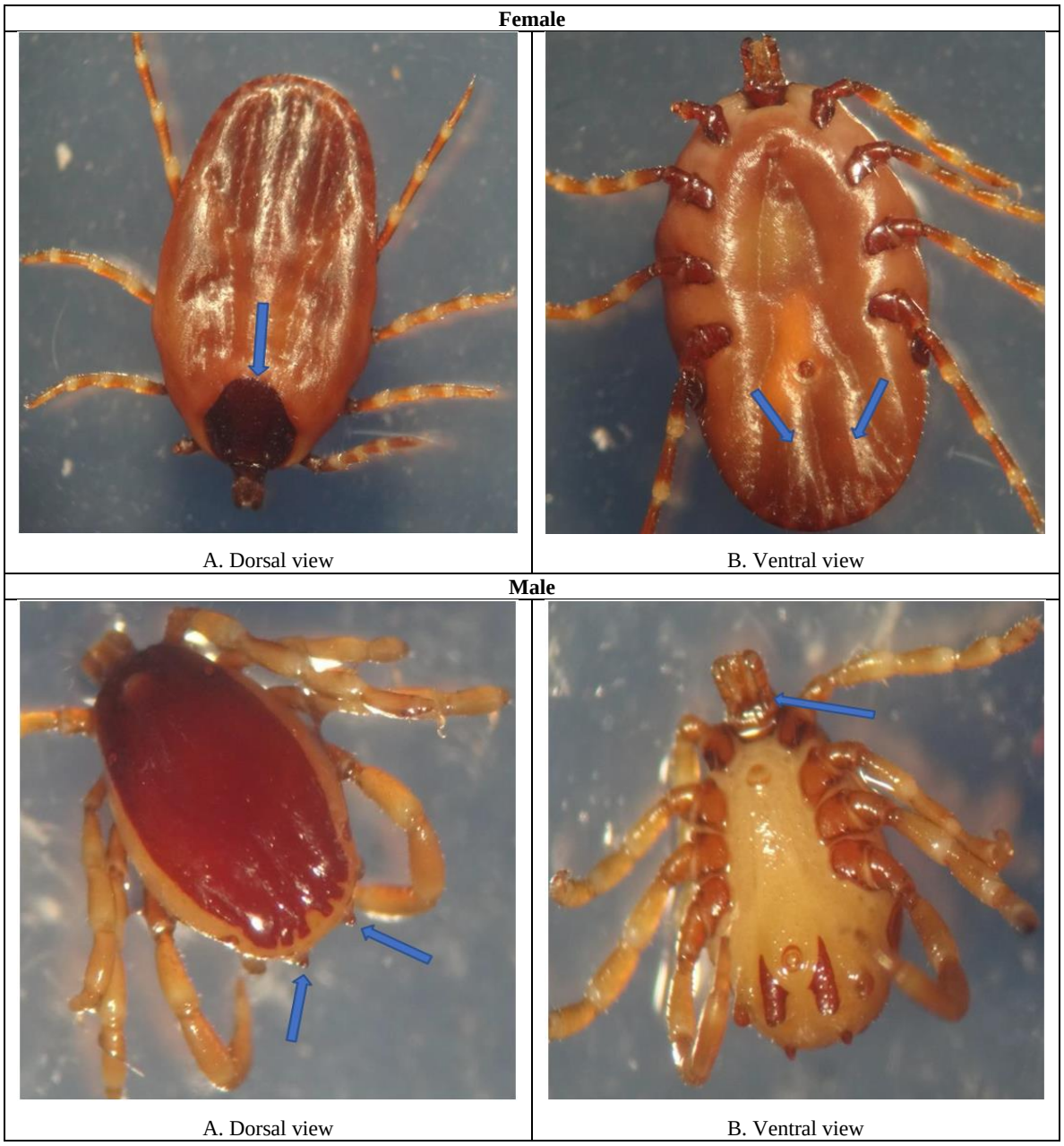
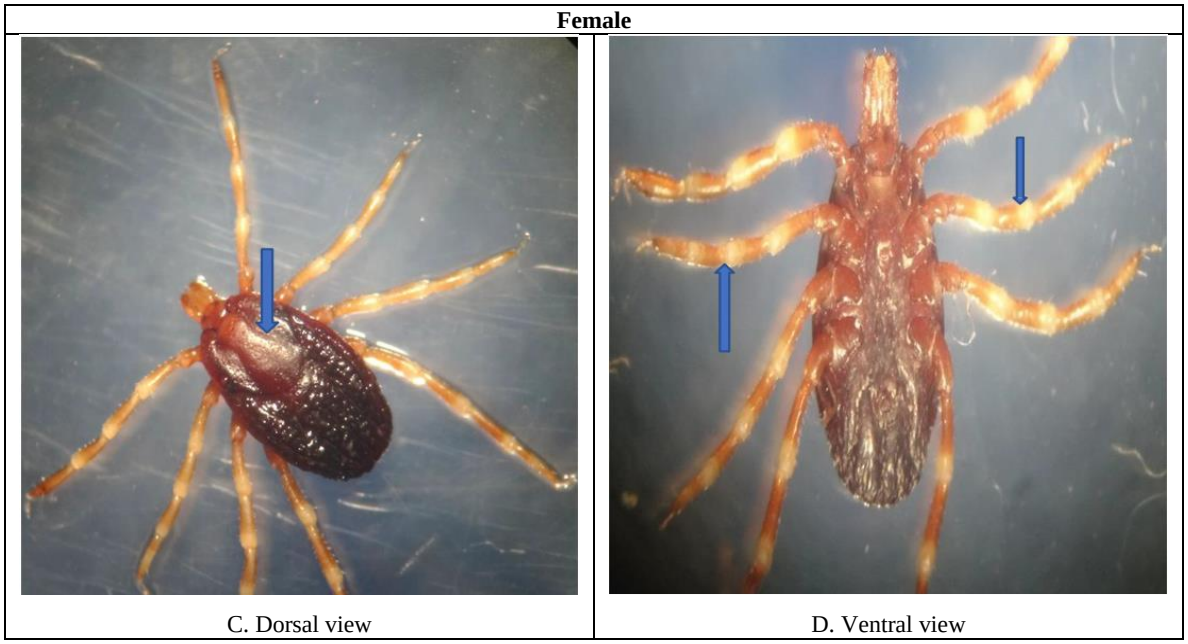


Fig 3: Identification of *Hyalomma dromedarii* through stereo-zoom microscope.



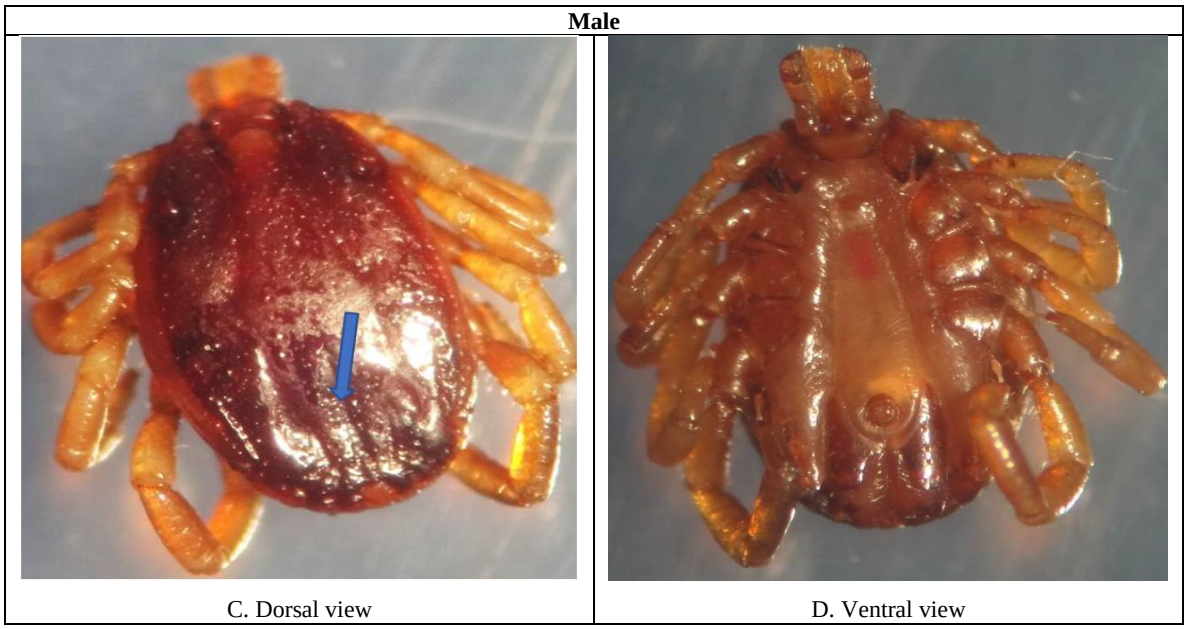


Fig 4(A): Identification of *Hyalomma anatolicum* through stereo-zoom microscope.

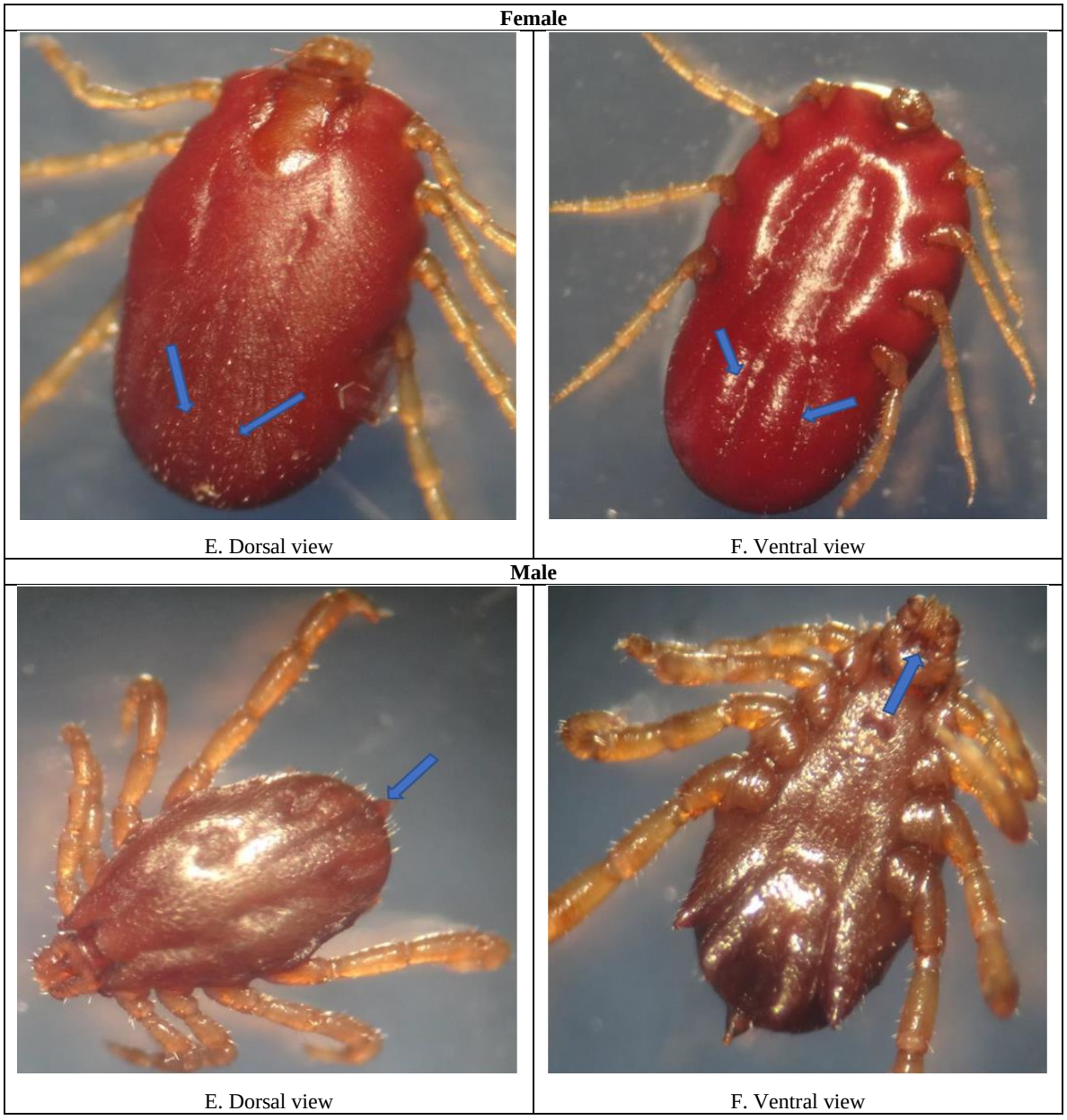


Fig 5: Identification of *Rhipicephalus* (*Boophilus*) *microplus* through stereo-zoom microscope.

Discussion

As per Livestock Census-2012, Gujarat possess 2, 71, 28, 200 Livestock contributing 5.30% to total 51, 20, 57, 000 livestock population of India. Gujarat is rich with various indigenous pure breeds of dairy animals. Saurashtra region of Gujarat is well known for breeding tract of excellent dairy cattle breed, Gir. The total cattle population of Saurashtra region i.e., breeding tract of Gir cattle is 2.5 million and Gir breed accounts for 37 percent of total cattle population in the region. This breed is also known as Bhodali, Desan, Gujarati, Kathiawari, Sorthi and Surti in different parts of the breeding tract. The Gir animals are famous for their tolerance to stress conditions and resistance to various tropical diseases.

The maintenance of animal productivity and reproductive health are the biggest challenge in tropical and/or sub-tropical climatic conditions which is very much favorable for the growth, developments and survivalism of parasites especially ticks and tick-borne pathogens. The trends of tick infestations were almost same from all over the India. Patel *et al.* (2012) [15] recorded 60.07% prevalence of tick infestation in cattle in Mathura, India. Similarly, in Punjab 58.06% tick infestations in cattle was recorded (Singh and Rath, 2013) [18].

Among the 27 valid species of *Hyalomma* (Guglielmone *et al.*, 2010) [8], at least 9 species of *Hyalomma* were recorded from India (Geevarghese and Dhanda, 1987) [5]. Almost all species are equally important and they are well known for its vector potentiality especially for Crimean Congo Haemorrhagic Fever (CCHF) virus and *Theileria annulata*. Similarly, species of *Rhipicephalus* (*Boophilus*) are well known for *Babesia* and *Anaplasma* transmission in cattle. For field veterinarians, morphological identification of ticks even up to genus level provides sufficient information to device the control strategy of ticks-and tick- borne diseases.

Similarly, high prevalence of ixodid ticks was reported from different workers and researchers including Tavassoli *et al.* (2013) [20] of West and North-West Iran, reported *Hyalomma spp.* was the major tick species (71.56%) affecting cattle. Singh and Rath (2013) [18] were observed maximum prevalence of *R.* (*B.*) *microplus* and *H. anatolicum* in Punjab state, India. Chhillar *et al.* (2014) [3] observed that *H. anatolicum* and *R.* (*B.*) *microplus* are the most common vector species infesting buffalo and cattle in Hayryana. Kaur *et al.* (2015) [11] and Khajuria *et al.* (2015) [12] both identified *R.* (*B.*) *microplu*s as a highly abundant in Lucknow, Uttar Pradesh and Jammu district, Jammu and Kashmir (India), respectively. Abdul *et al.* (2007) [1] reported *Rhipicephalus* (*Boophilus*) (46.1%) followed by *Hyalomma* (31.25%) and *Rhipicephalus* (17.93%). Patel *et al.* (2012) [15] reported two species of ticks namely *R.* (*B.*) *microplus* and *H. anatolicum* as common tick species infesting Indian zebu cattle at various locations of Mathura region of India. Rony *et al.* (2010) [17] reported highest prevalence of *R.* (*B.*) *microplus* (45.63%) in Gazipur district in Bangladesh through an epidemiological investigation. Kabir *et al.* (2011) [9] were also reported *R.* (*B.*) *microplus* as highest prevailing ixodid tick of the Chittagong District, Bangladesh. The difference among these studies could be attributed to a wide range of factors including agro-ecological, animal health practice, or management difference with in their respective study areas.

Conclusion and Recommendations

The present study identified a high prevalence rate of cattle ixodid ticks with two tick genera and species identified *Hyalomma*, *Rhipicephalus* (*Boophilus*) and mixed. Currently the ixodid tick infestation seems to be associated with different risk factors and result in severe constraint for agricultural activities in the settlement areas of the Saurashtra region of the Gujarat. So based on this survey, it could be recommended to the cattle owners of the region to follow proper animal health care practices and frequent observations on animals. They can be educated and aware of these hidden enemy (ixodid ticks and ticks borne diseases) and its socioeconomic effects. The collaborative efforts between the govt., non- govt. institutes, cooperatives, veterinarians and livestock communities can bring tick infection at the very low/ safe level.

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