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Epidemiological Aspects of Bovine Tick Infestation in the River Ravi Region, Lahore

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ABSTRACT

A total of 1258 bovines (n =726 cattle; n =532 buffaloes), positive for ticks, were included in the study to check determinants of tick infestation. *Hyalomma* was significantly (P<0.05) the most prevalent tick genus 71.9 and 62.03%, followed by *Boophilus* 22.04 and 28.57% and mixed infection 6.06 and 9.4% in cattle and buffaloes, respectively. Mild tick infestation (1-20 ticks/animal) was found significantly (P< 0.05) high, followed by moderate (21-50 ticks/animal) and high tick infestation (>50 ticks/animal) in bovines. In cattle, crossbreds were significantly (P<0.05) the most affected, followed by Sahiwal, Cholistani, Holstein Friesian and non-descript, respectively, while in buffaloes, non-descriptive breed was more affected than Nili Ravi. Females were significantly (P<0.05) the most affected gender than males in bovines. Calves were significantly (P<0.05) the most affected age group in both, followed by adult, young and old, respectively in cattle, while followed by young, adult and old, respectively in buffaloes. Udder was significantly (P<0.05) the highest tick infested site in both, followed by inner thighs, perineum, legs and tail, and neck, respectively in cattle, while followed by neck, tail, perineum, inner thighs, legs, and back and ears, respectively in buffaloes. Summer was significantly (P<0.05) the most tick favorable season, followed by winter, spring and autumn, respectively in bovines.

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Authors' Contributions
MI, AZD and AM conceived and designed the study. SA executed the experiment work and wrote the article. MMA and KM analyzed the data.

Key words
***Hyalomma*, *Boophilus*, cattle, buffaloes, tick infestation, Nili Ravi, *Bos indicus*.**

INTRODUCTION

Ecto-parasites such as ticks and mites transmit different pathogens, which lead to a number of threatening diseases (Aslam *et al.*, 2015). Ticks, most important ecto-parasites of livestock in tropical and sub-tropical areas such as Pakistan, are responsible for substantial economic losses (Durrani and Shakoori, 2009). Ticks are blood suckers that damage skins, hides and predispose cattle to dermatophilosis and myiasis (Mtshali *et al.*, 2004), induce paralysis or toxicosis, and cause physical damage to livestock. They are also vectors of a number of pathogenic microorganisms including viruses, bacteria, spirochetes, rickettsiae and protozoans (Jongejan and Uilenberg, 2004).

In Pakistan, the prevalence of tick infestation has been observed to go beyond 50% (Durrani, 2008; Sajid *et al.*, 2008, 2009a,b), but so far, only a few investigations concerning prevalence of tick infestation, taxonomy and acaricidal efficacy have been conducted (Sajid *et al.*, 2009a). Higher prevalence of *Hyalomma* tick followed by *Boophilus*, *Haemaphysalis*, and *Rhipicephalus* was reported in district Kasur (Durrani and Kamal, 2008), while higher prevalence of *Hyalomma anatolicum anatolicum* followed by *Rhipicephalus (Boophilus) microplus*, *Rhipicephalus sanguineus* and *Rhipicephalus annulatus* and *Haemaphysalis* spp. was reported in districts Sargodha, Khushab, and Rawalpindi (Durrani and Shakoori, 2009). In India, *Rhipicephalus* was the most prevalent tick genus reported on cattle, followed by *Hyalomma* and *Boophilus* (Raut *et al.*, 2008). Three species of ticks namely *Boophilus microplus*, *Rhipicephalus sanguineus* and *Haemaphysalis bispinosa* infesting cattle were documented in Bangladesh (Kabir *et al.*, 2011). *Hyalomma* was major tick species in the livestock of Iran (Shemshad *et al.*, 2012). *Boophilus microplus* and *Amblyomma cajennense* were identified predominant tick species on cattle in Guatemala (Teglas *et al.*, 2005). Breed, age, geographical area and month-wise prevalence of tick infestation are significant associated determinants. Predilection sites vary with host and infesting tick specie. Perineum, udder and external genitalia are the most tick infested sites followed by dewlap, inner thighs, neck and back, tail, ears, around eyes, flanks, and legs (Atif *et al.*, 2012).

The knowledge about the extent of the bovine tick infestation is extremely insufficient especially in

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buffaloes. Therefore, a study was designed to identify the most predominant tick genus and associated determinants in cattle and buffaloes.

MATERIALS AND METHODS

Study location

Epidemiological studies were conducted in cattle and buffalo population in the outskirts of Lahore district. Lahore is located on a flat alluvial plain on the left bank of River Ravi. Lahore District lies between 31°-15' and 31°-45' north altitude, 74°-01' and 74°-39' east longitude. It is situated in the north-eastern part of Pakistan, and bounded on the east by India. The general altitude of the area is about 213 m in the north-east to 208 m in the south-west above mean sea level. Lahore experiences extremes of climate. Climate of Lahore features a hot semi-arid climate with rainy, long and extremely hot summers, dry and warm winters, a monsoon and dust storms. The mean maximum and minimum temperature during summer months are 40.4°C and 27.4°C, while 22°C and 5.9°C in winter season respectively. The average annual rainfall in Lahore is about 629 mm with 34 rainy days (LDA, 2004; RRCAP, 2011).

Sampling strategy

The study was conducted from January, 2012 to December, 2012 in the semi-arid zone of the district. A total of 1258 tick specimens, found on bovine population (n=726 cattle; n=532 buffaloes), were collected from the field, small-scale livestock integrated farms, public and private hospitals located in the vicinity of 34 villages of the study district. The farmers had not used any acaricide for control of tick infestation on their animals. The animals were selected for sampling based on the presence of ticks on their bodies and showing any clinical signs like intermittent fever, loss of appetite, anemia, weight loss, dyspnea, pale mucous membrane, jaundice, and recumbency.

Collection, processing, and identification of tick specimens

Adult hard tick specimens were collected from different body parts of cattle without damaging their mouth parts using forceps. Each specimen was placed in a separate vial containing 70% ethyl alcohol and the labeled specimens were dispatched to Department of Parasitology, UVAS, Lahore, for taxonomic identification. Morphological characters of ticks were studied and identified, using stereo microscope according to the characteristics mentioned by Walker *et al.* (2003).

Epidemiological survey

Data regarding species, breed, sex, age and predilection site of the host, and climatic condition of the area, were recorded on a pretested questionnaire. Tick infestations were categorized into the following groups: mild (1-20 ticks per animal), moderate (21-50 ticks per animal) or high infestation (more than 50 ticks per animal) described by Teglas *et al.* (2005). Categories of cattle or buffaloes (male/female) based on their age ranges were as follows: (1) calves (<1 year); (2) young stock (1-3 years); (3) adult stock (3-5 years); (4) old stock (5-10 years). The breeds studied included: (1) Sahiwal (*Bos indicus*); (2) Cholistani (*B. indicus*); (3) Non-descript (*B. indicus*); (4) Cross-bred (*B. indicus*×*B. taurus*); (5) Holstein Friesian (*B. taurus*), while those of buffaloes (*Bubalus bubalis*) included: (1) Nili Ravi; (2) Non-descript. Four consecutive seasons were categorized as: (1) Spring (March to April); (2) Summer (May to August); (3) Autumn (September to October); (4) Winter (November to February).

Statistical analysis

Data regarding the prevalence of tick infestation and associated determinants by Non-parametric, Chi-square (χ^2) test were analyzed, using statistical product and service solutions (SPSS) version 16. Probability levels (P) of <0.05 were considered significant.

RESULTS AND DISCUSSION

Data regarding determinants affecting the prevalence of tick infestation and breed-wise prevalence in cattle and buffaloes is shown in Tables I, II. Prevalence of *Hyalomma*, *Boophilus* and mixed infection were found 71.9, 22.04 and 6.06% in cattle, while 62.03, 28.57 and 9.4% in buffaloes, respectively. Data showed the highest prevalence (P<0.05) of *Hyalomma*, followed by *Boophilus* and mixed infestation significantly, both in cattle and buffaloes. Durrani and Shakoori (2009) have also reported highest prevalence of *Hyalomma* ticks, followed by *Boophilus*, *Haemaphysalis* and *Rhipicephalus*, respectively in cattle of three districts; Rawalpindi, Lahore and Multan. Similar tick genera infestations were reported in Friesian cattle of district Kasur (Durrani and Kamal, 2008). Findings are also coincided with results of Sajid *et al.* (2009b), who reported that *Hyalomma* was the main tick genus found in cattle and buffaloes of Layyah and Muzaffargarh. Khan *et al.* (1993) has also been reported similar results for Faisalabad, Pakistan. Data regarding tick density revealed prevalence of mild, moderate and high tick infestation found 56.61, 32.64 and 10.74% in cattle, while 59.59, 30.64 and 9.77% in buffaloes. Mild tick infestation was

Table I.- Determinants affecting the prevalence of tick infestation in cattle and buffaloes of Lahore district.

Variable	Category	Cattle			Buffaloes		
		Frequency	%	P-value	Frequency	%	P-value
Tick genus	*Hyalomma*	522	71.9	0.000*	330	62.03	0.000*
	Boophilus	160	22.04		152	28.57	
	Mixed infestation	44	6.06		50	9.4	
Tick density	Mild	411	56.61	0.000*	317	59.59	0.000*
	Moderate	237	32.64		163	30.64	
	High	78	10.74		52	9.77	
Host sex	Male	121	16.67	0.000*	95	17.86	0.000*
	Female	605	83.33		437	82.14	
Host age (group)	Calf	208	28.65	0.012*	168	31.58	0.000*
	Young	173	23.83		139	26.13	
	Adult	189	26.03		123	23.12	
	Old	156	21.49		102	19.17	
Host predilection site	Back	00	00	0.000*	42	7.89	0.000*
	Ears	00	00		42	7.89	
	Inner thighs	140	19.28		59	11.09	
	Legs	68	9.37		43	8.08	
	Neck	34	4.68		101	18.98	
	Perineum	106	14.6		60	11.28	
	Tail	68	9.37		80	15.04	
	Udder	310	42.7		105	19.74	
Season	Spring	133	18.32	0.000*	105	19.74	0.000*
	Summer	272	37.47		197	37.03	
	Autumn	130	17.91		69	12.97	
	Winter	191	26.31		161	30.26	

*Significant difference (P<0.05) was observed between tick genus, tick density, sex, age groups, predilection site and various seasons.
Mixed infestation, *Hyalomma+Boophilus*; Mild, 1-20; Moderate, 21-50; High, >50 ticks/animal.
Spring, March-April; Summer, May-August; Autumn, September-October; Winter, November-February.

Table II.- Host breed-wise prevalence of tick infestation in cattle and buffaloes of Lahore district.

Species	Frequency (%)	P-value
Cattle		
Sahiwal	173 (23.83)	0.000*
Cholistani	124 (17.08)	
Non-descript	93 (12.81)	
Cross-bred	217 (29.89)	
Friesian	119 (16.39)	
Buffalo		
Nili Ravi	253 (47.56)	0.111
Non-descript	279 (52.44)	

*Significant difference (P<0.05) was observed among various breeds of cattle while non-significant difference (P>0.05) was seen in buffaloes.

significantly (P<0.05) predominant, followed by moderate and high, both in cattle and buffaloes. The results of the present study are completely in line with the findings of Teglas *et al.* (2005), who also reported mild tick infestation in bovines. Cattle are likely to be more economically important to many subsistence farmers and therefore receive veterinary care more consistently (Teglas *et al.*, 2005). Data regarding host breed showed that the highest prevalence was found in crossbreds (29.89%), followed in order by Sahiwal (23.83%), Cholistani (17.08%), Holstein Friesian (16.39%) and non-descript (12.81%) in cattle, while in buffaloes, prevalence was found the highest in non-descript (52.44%), as compared to Nili Ravi (47.56%). Breed was found to be a significant (P<0.05) determinant in cattle, while non-significant (P>0.05) in buffaloes affecting the prevalence of tick infestation. Present research on

determinants of host breeds showed that tick infestations were higher in crossbreds and exotic as compared to indigenous animals in case of cattle species, whereas non-descriptive buffaloes were more affected. It confirmed findings of L'Hostis *et al.* (1996); Atif *et al.* (2012), they found higher tick infestation in crossbreds. Sajid and associates have reported higher prevalence of tick infestation in crossbred cattle of 5-10 years of age (Sajid *et al.,* 2009b). Wambura *et al.* (1998) has noticed that *B. indicus* is relatively resistant to ticks as compared to *B. indicus* and *B. taurus* crosses. They associated the higher concentration of serum complements for tick resistance in zebu cattle. Indigenous cattle breeds are more resistant to tick infestation than European breeds (Sajid *et al.,* 2009b). Tick resistance is an inherited trait in *B. indicus* cattle (Jongejan and Uilenberg, 2004). Data regarding host sex revealed the prevalence in males and females was 83.33 and 16.67% in cattle, while 82.14 and 17.86% in buffaloes, respectively. Data showed higher prevalence was found in females than males in both species. Sex was found a significant ($P<0.05$) risk factor both in cattle and buffaloes. Unlikely, Sajid *et al.* (2009b) reported higher prevalence of tick infestation in males than in females of cattle and buffaloes. This contradiction is due to the trend of using artificial insemination instead of natural service for better production and due to the revolution of modern dairy farming in Pakistan. Data regarding host age showed higher numerical figures of ticks in per unit of surface in calves (28.65%), followed by adults (26.03%), young (23.83%) and old ones (21.49%) in cattle, while in buffaloes, higher number of ticks were found in calves (31.58%), followed by young (26.13%), adults (23.12%), and old ones (19.17%). Age was a less significant ($P<0.05$) risk factor in cattle as compared to buffaloes. The results of present study on host determinants of age regarding tick infestation concluded that either cattle or buffaloes, calves were more susceptible age group. These results coincide with L'Hostis *et al.* (1996) who depicted higher tick infestation in calves as compared to their elder members of young stock. Lack of immunity, softer tissues and thinner skin of young animals would help in the penetration of mouth parts for feeding (Sajid, 2007). Data regarding tick predilection site on host body revealed that udder is the highest ($P<0.05$) infested site of tick infestation (42.7%), followed by inner thighs (19.28%), perineum (14.6%) legs (9.37%) and tail (9.37%), and neck (4.68%) in cattle. In buffaloes, udder was found the highest infested site of tick infestation (19.74%), followed by neck (18.98%), tail (15.04%), perineum (11.28%), inner thighs (11.09%), legs (08.08%), and back and ears (7.89%), respectively. Predilection site was found to be a significant ($P<0.05$) risk factor both in cattle and buffaloes. Results confirmed the findings of Atif *et al.* (2012), who reported perineum, udder and external genitalia, the most tick infested sites in cattle followed by dewlap, inner thighs, neck and back, tail, ears, around eyes, flanks, and legs. Data regarding season revealed summer season (37.47%) was most favorable for tick infestation followed by winter (26.31%), spring (18.32%), and autumn (17.91%) in cattle, while in buffaloes, summer (37.03%) was most favorable season for tick infestation followed by winter (30.26%), spring (19.74%), and autumn (12.97%). Season is a significant ($P<0.05$) determinant in cattle and buffaloes affecting prevalence of tick infestation. Considering the higher number of ticks, summer season was the most favorable for tick infestation followed by winter, spring, and autumn both in cattle and buffaloes. These findings were correlated with Marufu *et al.* (2011), who reported that higher prevalence of cattle tick infestation in hot-wet season and Durrani (2008), who revealed *Hyalomma* spp. ticks were most abundant in June, in Pakistan. Rainfall influences microclimate by affecting vegetation growth and soil moisture. High rainfall and relative humidity during summer shape climate favorable for growth of ticks and their parasitic activity in livestock (Mooring *et al.,* 1994). The prevalence of tick infestation varies from region to region. Host, management and environmental factors (agro-ecological and geo-climatic conditions) influence the prevalence of ticks (Kivaria, 2006).

It is concluded that *Hyalomma* and *Boophilus* were the most prevalent tick genera in cattle and buffaloes in Lahore region, Pakistan, and preventive measures should be done to control infestation, especially during summer.

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