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Short Communication

Prevalence of *Rhipicephalus* and *Hyalomma* Ticks in Cattle and Associated Risk Factors in Three Districts of Khyber Pakhtunkhwa, Pakistan

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ABSTRACT

Ticks as vectors of various human, livestock and companion animal diseases are most important globally. In accordance to its economic impact the current study was conducted in three districts of Khyber Pakhtunkhwa (KP) province of Pakistan i.e. Mardan, Kohat and Swat. The aim of this study was to assess the prevalence of ixodid ticks and associated animals' related risk factors. A total of 434 tick infested cattle from three districts were examined conveniently. The genus *Rhipicephalus* was the most prevalent (68.4%) followed by *Hyalomma* (19.6%) and mixed tick infestation (12%) in all study districts, respectively. The difference in prevalence of tick infestation was non-significant among the breeds with the exception of crossbred cattle in which it was found significantly ($p<0.05$) high. Sex and age of the cattle were non-significantly ($p>0.05$) associated with prevalence of tick infestation. However, the male and young animals were affected more as compared to female and adult animals. Body regions wise distribution of tick infestation revealed that, external genitalia was the most favorite site for tick infestation (73.73%) followed by inner thighs (65%), dewlap (62.21%), neck and back (56.68%), tail (34.56%), around eyes (16.13%), legs (13.36%), ears (11.06%), and flank region (5.76%). This study concludes that *Rhipicephalus* is the most prevalent tick genus of the study districts. Furthermore, crossbred cattle, young and male animals are at higher risk to tick infestation. The hidden parts of body are infested most by tick infestation.

Ticks are considered as the most important vectors of various human, livestock and companion animal diseases, globally. Protozoa, pathogenic bacteria, rickettsiae, viruses and spirochetes are transmitted mechanically or biologically by ticks (Ghosh *et al*., 2007). Ticks are ectoparasites and are responsible for causing infestation in about 80 % population of cattle worldwide (FAO, 1984). In nonhuman vertebrates ticks causing different bacterial, viral, protozoal and rickettsial diseases and as a vector rank first while in human as a vector rank second after mosquitoes (Zhou *et al*., 2009). Ticks are responsible for the transmission of various blood protozoan diseases like; theileriosis, babesiosis (Durrani and Kamal, 2008) and rickettsial anaplasmosis (Kocan *et al*., 2004). Ticks are directly involved in heavy losses like blood loss, damage to skin and udder, tick worry, loss of body weight and toxin production, respectively. Tick genera i.e. *Hyalomma, Rhipicephalus, Haemaphysalis* and *Ornithdoros* are distributed throughout Pakistan infesting animals and humans (Robertson *et al*., 1970). Among ixodid ticks, *Hyalomma, Boophilus, Amblyomma* and *Rhipicephalus* are the tick genera prevalent in various livestock species in Peshawar region of KP province, Pakistan (Manan *et al*., 2007). *Hyalomma, Haemaphysalis, Boophilus (Rhipicephalus)* and *Rhipicephalus* are the ticks genera found in Punjab province of Pakistan (Durrani and Kamal, 2008). The genus *Hyalomma* tick (12%) is the predominant tick in cattle of district Lahore followed by *Rhipicephalus* (3.1%) (Durrani and Shakoori, 2009). *Rhipicephalus* and *Hyalomma* are the major tick genera which act as vectors for hemoparasitic diseases of livestock in Pakistan.

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Babesia bigemina, *B. Bovis* and *Anaplasma marginale* are mainly transmitted by *Rhipicephalus microplus* (cattle tick) in Pakistan and worldwide (Perveen, 2011). *Hyalomma, Rhipicephalus* and *Haemaphysalis* are the hard ticks (family Ixodidae) and two genera of soft ticks *Argas* and *Ornithodorus* (family Argasidae) are identified from different parts of Pakistan. The most prevalent tick genus is *Rhipicephalus* in three zones of KP province, *Haemaphysalis* ranks second followed by *Hyalomma, Dermacentor* and *Amblyomma*, respectively (Farooqi *et al*., 2017). Livestock sector in Khyber Pakhtunkhwa faces a serious threat from tick infestation (Farzana *et al*., 2010).

Therefore, the current study was designed with the aim to estimate the hard tick genera of family Ixodidae infesting various cattle breeds residing in the three districts of KP province which would help in assessment of its prevalence and also in designing effective control strategies for future.

Materials and methods

KP province is divided into three zones on the basis of rainfall and temperature. These regions are; northern, central and southern zones. At least one district was selected from each of the zones i.e. Swat (35.2227° N latitude, 72.4258° E longitude) from the northern zone, Mardan (34.1989° N latitudes, and 72.0231° E longitude) form the central zone and Kohat (33.5889° N latitude, 71.4429° E longitude) from the southern zone, respectively. June is the hottest month of summer with a maximum temperature of 33°C while January is the coldest month of winter with a minimum temperature of -2°C in district Swat. Highest temperature in district Mardan is 46.5°C in June and lowest is 0.5°C in January. District Kohat has 47°C highest temperature in June and 3°C in January.

The tick samples were collected from different union councils of the selected districts of the KP province. These samples were collected from small holder farms. A total of 434 tick infested cattle were examined from the study districts.160 tick samples were collected from district Mardan, 131 from Kohat and 143 from district Swat using convenient method (Muhib *et al*., 2001). Cattle sex and age wise groups were examined. Achai (*B. indicus*), Sahiwal (*B. indicus*), Friesian (*B. taurus*) and cross-bred (*Bos indicus* × *Bos taurus*) were the cattle breeds from which ticks specimens were recorded.

The tick samples were collected from March 2018 to February 2019. At least one tick and maximum up to 5 ticks were collected from each animal depending upon the availability of ticks. A pretested questionnaire was used for the collection of data regarding date of collection, details about the animal (sex, age and breed), place of collection and body site of collection. Ticks were collected at morning and evening from different regions of the body of animals i.e. Neck and back region, axillary region, perineum and dewlap of animals with the use of forceps carefully without damaging their mouthparts. For the preservation of collected tick's specimens labeled disposable tubes containing 70% ethanol solution were used to preserve their morphology. The preserved tick samples were carried to the Laboratory of Entomology, Department of Parasitology, The University of Veterinary and Animal Sciences, Lahore. Stereomicroscope was used for identification of ticks up to genus level with the help of specific morphological keys (Keirans and Litwak, 1989).

Pearson's Chi-square (χ^2) was used for the data regarding tick prevalence and other associated risk factors using statistical package for social science (SPSS) version 20. P value < 0.05 was considered significant for risk factors associated with tick burden.

Results and discussion

Two genera of ticks were identified i.e. *Rhipicephalus (Boophilus)* and *Hyalomma* either alone or as mixed infestations. The *Rhipicephalus* (*Boophilus*) and *Hyalomma* were the predominant ixodid tick genera in all the three study districts of KP province. The study showed a non-significant relationship between the tick infestation and factors like study districts, age, sex and cattle breed except crossbred where the relationship was found significant (P< 0.05) by chi square test. The results showed that *Rhipicephalus* is the leading tick genus followed by *Hyalomma* and mixed infestation in all three districts of KP province (Table I). This coincides with findings of Farooqi *et al*. (2017) and Haque *et al*. (2011) . Hard ticks of family Ixodidae like *Rhipicephalus, Hyalomma, Dermacentor* and *Amblyomma* have previously been reported by a number of researchers like Muhammad *et al*. (2008) in Pakistan and Ghosh *et al*. (2007) in Bangladesh, India and Pakistan. The reports of these researchers support the findings of our project with slight differences due to the seasonal variations in the study periods, climatic and topographic variations of Pakistan, India and Bangladesh. The higher prevalence of hard tick genera in Pakistan can be attributed to mixed species farming with fewer facilities. In such conditions, the overcrowding and mixing of infected animals with healthy cause transfer of vectors and resultant diseases among animals.

In the current study, there was a high prevalence of tick infestation in Friesian and cross-bred (*Bos indicus* × *Bos taurus*) than local breeds i.e. Achai and Sahiwal. Exception to *Rhipicephalus* tick infestation was observed in local breed (Achai) where it was higher in all the three study districts (Table I). European breeds i.e. Jersey, Friesian and their crosses have longer and denser hair which make them an easy victim of tick infestation due to extensive hiding space for the tick vectors and that is why

there is higher tick infestation in these European breeds than local breeds. Another factor responsible for higher tick prevalence is the development of better resistance in indigenous breeds than exotic breeds due to constant exposure. Jongejan and Uilenberg (2004) has given similar justification in their studies. The findings of Atif *et al*. (2012) and Farooqi *et al*. (2017) have agreements with our study. However, it does not conform to the work done by Kabir *et al*. (2011) who reported higher tick infestations in local breeds of cattle than crossbred. On the other hand, the above findings also support our study as there is also high *Rhipicephalus* tick prevalence in local breed (Achai). The reason for higher infestation status of local animals than exotics can be the level of care provided to exotics due to their higher production level with resultant higher revenue generation to the farmer.

Table I. Breed wise prevalence (%) of ixodid ticks in three districts.

	Breed	Mardan n (%)	Kohat n (%)	Swat n (%)
Rhipicephalus	Friesian	24(68.61)	11(64.70)	21(65.60)
	Cross breed	38(55.10)	46(71.90)	51(73.90)
	Achai	36(80.00)	32(82.11)	21(63.62)
	Sahiwal	08(72.71)	05(45.50)	04(44.40)
	106(66.3)	94(71.8)	97(67.8)	297(68.4)
Hyalomma	Friesian	11(31.40)	03(17.60)	07(21.90)
	Cross breed	21(30.40)	10(15.60)	09(13.00)
	Achai	07(15.60)	03(7.70)	08(24.20)
	Sahiwal	01(09.11)	03(27.30)	02(22.20)
	40(25.0)	19(14.5)	26(18.2)	85(19.6)
Mixed infestation	Friesian	0(0.0)	03(17.60)	04(12.50)
	Cross breed	10(14.50)	08(12.51)	09(13.00)
	Achai	02(04.40)	04(10.30)	04(12.10)
	Sahiwal	02(18.21)	03(27.33)	03(33.30)
	14(8.8)	18(13.7)	20(14.0)	52(12)

Age is also considered an important factor that determines tick infestation and is still debatable. The current study reported that there was higher prevalence of tick infestation in young animls than adult (Table II). These findings are supported by the studies conducted by Kabir *et al*. (2011) and Singh and Rath (2013) according to whom adult cattle were infested less than young animals. The possible reasons for this variation in results can be attributed to less developed immune system to tick infestation as a result of less or no exposure to tick vectors previously in young animals. Secondly, the young animals receive least of attention from the small holder farmers because their major focus is on lactating animals, which is the main source of their livelihood. The studies quoted above with higher infestation status in adult animals can be due to the fact that, poor body conditions decrease the immune status of the animals which favor high prevalence of tick infestation in adult cattle (Farooqi *et al*., 2017).

Table II. Age wise prevalence (%) of ixodid ticks in three districts.

	Age	Mardan n (%)	Kohat n (%)	Swat n (%)
Rhipicephalus	Young stock	22(64.71)	26(76.50)	22(68.82)
	Adult cattle	84(66.71)	68(70.10)	75(67.62)
Hyalomma	Young	10(29.40)	03(08.81)	06(18.80)
	Adult	30(23.81)	16(16.50)	20(18.00)
Mixed infestation	Young	02(05.91)	05(14.70)	04(12.51)
	Adult	12(09.50)	13(13.41)	16(14.40)

Sex of the animal is another important determinant of tick infestation. Male cattle showed higher prevalence of tick infestation than female cattle (Table III). Our findings correlate with Musa *et al*. (2014) who reported higher prevalence of tick infestation in male than in female. This is because the males are mostly used for drought purposes and exposure to vectors remains high when they move to fields and other places for work, while in female cattle exposure is comparatively lower because they are mostly used for dairy and breeding purposes in confinements (Hitcheock, 1993). Another justification for these findings are that farmers give more attention to female cattle use for milk production than male (Bullocks) mostly use for meat and draught purposes so receiving less attention. However, our results mismatch with Kabir *et al*. (2011) who reported higher prevalence of tick infestation in female than in male cattle. But on the other hand some of our findings also correlate with the above researchers. The possible reasons for higher infestation in female animals are number of stressors in female through their productive lives, which include heats, pregnancies, parturitions and lactations etc.

This study revealed that external genitalia was the most favorite site for tick infestation followed by inner thighs, dewlap, neck and back region, tail, around the eyes, legs, ears and flank region (Table IV). (Reik, 1962) and (Atif *et al*., 2012) have reported similar findings which coincide with our findings. Thinner and shorter skin are richly supplied with blood vessels which help in penetration of tick mouth parts easily and act as favorite site for tick infestations. It was observed from the results that there was higher prevalence of tick infestations in summer than winter season. As the heavy rains and high temperature in summer season facilitate the tick survival and propagation making it the most appropriate reason for the higher number of tick infestations in this season. On the other hand, low temperature, dry weather and short day length oppose the tick survival and propagation, which is why the lower tick number can be attributed to these

factors during the colder season of the year. The findings of Kumar *et al*. (2004) and Kabir *et al*. (2011) correlate with our study.

Table III. Sex wise prevalence (%) of ixodid ticks in three districts.

	Sex	Mardan n (%)	Kohat n (%)	Swat n (%)
Rhipicephalus	Male	32(66.70)	35(81.41)	27(69.20)
	Female	74(66.10)	59(67.01)	70(67.30)
Hyalomma	Male	14(29.21)	04(09.30)	07(17.90)
	Female	26(23.20)	15(17.01)	19(18.30)
Mixed infestation	Male	02(04.20)	04(09.31)	05(12.80)
	Female	12(10.70)	14(15.91)	15(14.40)

Table IV. Distribution rate (%) of hard ticks (ixodid) on different parts of body of cattle.

S. No	Body parts	Total infested animals	Animals with infested sites	Percentage
1	External genitals	434	320	(73.73%)
2	Dewlap	434	270	(62.21%)
3	Inner thighs	434	280	(65.00%)
4	Neck and back	434	246	(56.68%)
5	Tail	434	150	(34.56%)
6	Around Eyes	434	70	(16.13%)
7	Ears	434	48	(11.06%)
8	Legs	434	58	(13.38%)
9	Flank region	434	25	(5.76%)

Conclusion

This study concludes that *Rhipicephalus* (*Boophilus*) was the predominant tick genus of cattle population in all three study districts of KP province followed by genus *Hyalomma.* There was a non-significant association between tick infestation and certain factors like age, sex and breed. However, the data flow showed higher ticks prevalence in exotics and their crosses, male and young animals.

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Statement of conflict of interest

The authors have declared no conflict of interest.

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