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.
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 (χ²) 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 1). 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 1). 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)    | 29(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)    | 15(19.6)   |
| Mixed infestation |          |             |            |
| Friesian       | 00(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 animals than adult (Table II). 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 (Hitchcock, 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        Male | 02(04.20)  | 04(09.31)   | 05(12.80)  |
| infestation  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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