INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 10, No. 3, p. 50-61, 2017
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

# An epidemiological survey on diversity and seasonal distribution of hard ticks in sheep and goats in Multan, Pakistan

**Muhammad Riaz[1*], ZahidaTasawar[1], Muhammad Zaka Ullah[2]**

[a]*Zoology Division, Institute of Pure and Applied Biology, Bahauddin Zakariya University, Multan, Pakistan*

[b]*Department of Parasitology, Faculty of Veterinary Sciences, Bahauddin Zakariya University, Multan, Pakistan*

Article published on March 23, 2017

**Key words:** Ticks, Sheep, Goats, *Hylomma anatolicum, Rhipicephalus sanguineus.*

**Abstract**

Tick infestation is the major obstacle in livestock spreading in the tropical and subtropical region of the world. The purpose of the present study was to determine the tick infestation in small ruminants in district Multan, Pakistan. During sampling the adult ixodid ticks were collected from sampled animals and identified on the basis of shape of scutum, leg color, body, coxae one and ventral plates. The results showed the prevalence of tick infestation was 48.0% in small ruminants. Sheep was more infested with ticks (50.0%) compared to goats (43.6%). *Hylomma anatolicum* was the dominant tick species 52.2% followed by *Rhipicephalus sanguineus* 17.4%. The mixed infection was found 30.4% in small ruminants.The sex wise prevalence was higher in females (48.5%) than in males (45.2%). The tick prevalence based on age recorded higher in age >3 years was 52.3%, in age 1-2 years was 45.2%and lower in age <1 year (44%) respectively. Among sheep the highest prevalence was in Lohi breed (51.0%) than Kajli breed (50.0%) while in goats highest tick infestation was reported in Beetal breed (52.6%), followed Nachi breed (42.7%), and Teddy breed (39.2%).The result indicated that significantly higher tick prevalence was in June (81.0%) and lower in November (350%). The higher tick infection was recorded in summer season (77.7%) followed by autumn season (52.3%), spring season (50%) and lowest in winter season (11.1%).Breed wise prevalence revealed Lohi breedin sheep (51%)and Beetal breed in (52.6%) was more infested..The present study shown It was found that in sheep internal ear (94%) and external ear (80%) and in goats internal ear (95%) were the most infested sites.

***Corresponding Author:** Muhammad Riaz ✉ mriaz_sabri@yahoo.com

## Introduction

Small ruminants play key role in economical setting and ecological niche in Asian countries. Livestock owners in rural communities earned their daily income through trade of surplus animals and their byproducts (Irshad *et al.,* 2010). Pakistan, next to China and India is the dominant goat generating country throughout the world. Livestock, the pivotal part of agricultural economy of Pakistan, is adversely affected by ectoparasitic infestation such as ticks (Sajid *et al.*, 2008).Ticks being vectors of bacterial, protozonal, spirocheatal and viral diseases transmit pathogens to humans and livestock animals ( Kaker, 2008). Major obstruction in livestock expansion is tick-borne diseases such as theileriosis, bebesiosis, anaplasmosis and heartwater (Ahmad *et al.*, 2007).

The impact of ticks and tick-borne diseases (TTBDs) had been ranked very high on the livelihood of resource poor farming communities. Ticks not only damage hides and skins of infested animals but also impedes with meat and milk production which causes great economic losses all over the world (Desalegn *et al.,* 2015).Ticks restricted growth of young animals due to blood meal which resulted in thin, stunted and weak production of livestock ruminants (Jonsson *et al.*, 1998). Livestock sector miserably damaged due to tick-borne diseases by reducing 14% lactation in the infested animals. Ticks resulted in annual loss of USS 500000 from hides and skin downgrading in eastern Ethopia (Desalegn *et al.,* 2015). The global cost estimated for treatment of tick borne diseases is between USS 13.9 to 18.7 billion annually (De Castro, 1997).

Pakistan being part of tropical region has greater tick fauna (Rasul and Akhtar, 1975) and surveillance studies conducted in domestic and wild animals revealed higher tick prevalence (Manan *et al.,* 2007). Tick and tick-borne diseases (TTBDs) affect 80% livestock population in tropical and subtropical part of world including India, Pakistan and Bangladesh. The climatic conditions for tick growth and development are favorable in these countries (Ghosh*et al.*, 2007).

The information regarding tick infestation, tick taxonomy and efficacy of different acaricidal used for tick control is diminutive in Pakistan (Khan *et al.*, 1998). Most studies conducted are institutional based and not more than a decade old, furthermore ignored those areas which have heavy livestock population such as lower Punjab, Pakistan (Iqbal *et al.,* 2013; Khan *et al.*, 1993). The objective of the present study was to determine distribution of tick species infesting sheep and goats in district Multan, Southern Punjab, Pakistan.

## Materials and methods

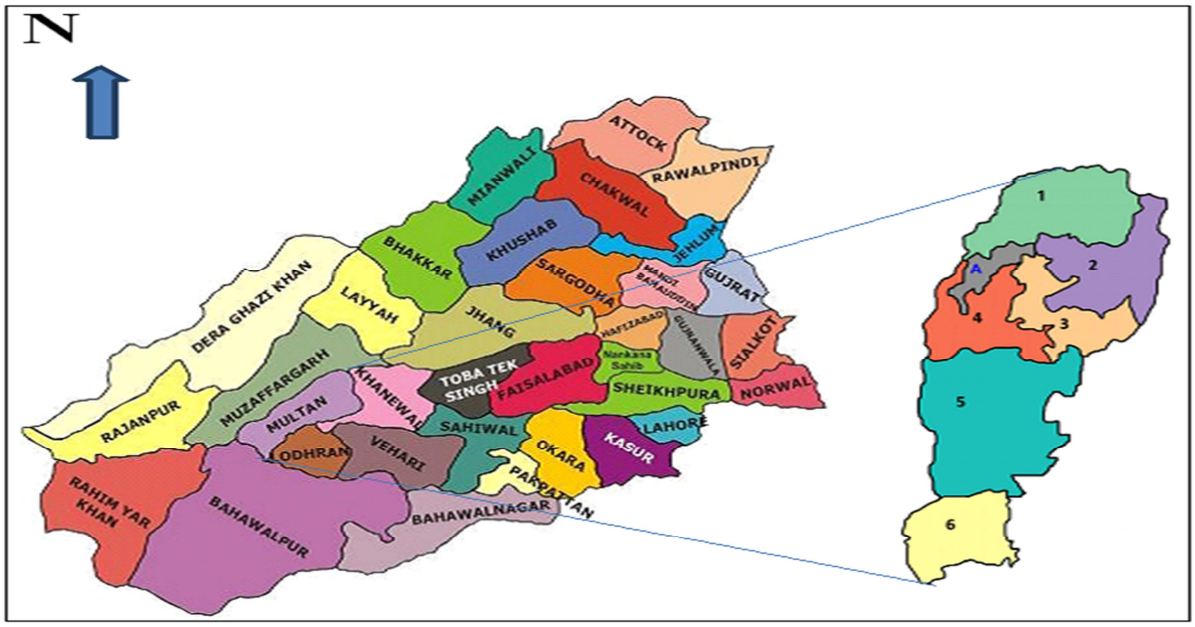
*Study Area*

The present study was conducted in the district Multan, Punjab, Pakistan. The data was collected from six administrative towns of district Multan including Bund Bosan, Shahruknealam, Shershah, Mumtazabad, Shujaabad and Jalalpur.

The district Multan is situated between 29'-22'north latitude and 71'-4' east longitude with mean annual temperature 25 ºC with an average rainfall of 127 mm. Topographically rivers, canals and narrow water channels divide the vast plain grounds of district Multan. Multan is located in a bend created by five confluent rivers. Small holder mixed farming system is the main mode of production of the farmers in the studied area.

*Study design and sampling strategy*

A cross sectional study was conducted on small ruminants (sheep and goats) of both sexes, different age groups and breed to collect ticks in Multan district from January 2013 to December 2013. Farm and herd selection was established based on the criteria of distance from one farm to other was not less than 10 km and 10% animals were sampled from each herd. A questionnaire was made to collect the information and associated risk factors involved in the severity of infestation in small ruminants during field survey.




Study Area of district Multan, Punjab, Pakistan

**Fig.** 1. Mumtazabd 2. Shahruknealam 3. Sher shah 4. Bund Bosan 5. Shuja abad 6. Jalal pur.

During sampling the adult ixodid ticks were removed from surveyed animals and collected carefully in bottles containing 70% ethyl alcohol as preservative.

The bottles were properly labeled with species of animals, gender and date of collection. The tick samples were brought to the laboratory of Institute of Pure and Applied Biology, Bahuddin Zakryyia University, Multan and were identified. The sampled ticks were spread on filter paper to absorb excessive preservative.

Permanent mounts of the tick specimens were prepared. Ticks were identified on the basis of shape of scutum, leg color, body, coxae one and ventral plates. Tick classification was done by using stereoscope based on identification key Walker *et al.* (2003).

Various determinants including month, season, area under study, gender, age, and breed were studied to determine their impact on tick prevalence. The data of temperature, rainfall and relative humidity was collected from Meteorological Department of Multan, Pakistan. Body parts of surveyed animals were examined for tick predilection sites.

*Data management and analysis*

The filed data of collected ticks were analyzed by using Minitab 16 softwear package. The tick infestation was determined by dividing the number of positive animals by the total number of animals surveyed expressed as percentages. Three age groups of studied animals were made: 1 year, 1-2 year and 3 year. Breed-wise tick infestation studied both in sheep (Lohi and Kajli) and goats (Beetal, Nachi, Teddy). Chi-square test ($X^2$) was used to assess the significant level of tick prevalence in studied ruminants. A p values less than 0.05 were considered as significant for data analysis.

**Results and discussion**

Of the total 1200 surveyed small ruminants (sheep and goats), 574 (48.0%) were infested by one or more tick species. The tick infestation rate in sheep and goats was 50.0%, 43.6% respectively (Table 1).

The single tick presence on the surveyed animal considered them as positive for tick infestation. Similar trends of higher tick infestation in sheep were reported from different parts of country which is in agreement to the present study: 31% in sheep and 29% in goats from Sindh by Hussain (1980); 12.8% in

sheep and 12.0% in goats from Peshawar by Manan *et al.* (2007) and 43.37% in sheep and 41.53% in goats from Lahoreby Irshad *et al.*, (2010). The higher infestation of ticks in sheep may attributed to sheep wool which provide suitable environment for ticks (Yagoub *et al.*, 2014) while distinct grooming behavior in goats reduced tick attachment to body (Tasfaye *et al.,* (2012), butcontradicts to Sertse and Wessone (2007) and Mulugeta *et al.,* (2010) who reported higher prevalence of ticks in goats compared to goats.

**Table 1.** Relative abundance of tick species species infesting in small ruminants (sheep and goats) of district Multan, Punjab, Pakistan.

| Tick species | Total count | Percentage % |
|---|---|---|
| *Rhipicephalus sanguineus* | 100 | 17.39 |
| *Hylomma anatolicum* | 300 | 52.17 |
| Mixed infection | 175 | 30.43 |
| Total | 575 | - |

**Table 2.** Results of statistical analysis of different epidemiological factors in sheep and goats of district Multan, Southern Punjab, Pakistan.

| Variables | Category | Number examined | Number (%) found to be infested | Significance |
|---|---|---|---|---|
| Species | Sheep | 737 | 374 (50.7) | $X^2 = 6.128$ |
| | Goats | 463 | 201 (43.4) | P = 0.013 |
| Sex | Male | 217 | 98 (45.16) | $X^2 = 0.806$ |
| | Female | 983 | 477 ( 48. 52) | P = 0.369 |
| Age | ≤I year | 310 | 138 (44.00) | |
| | 1-2 year | 420 | 190 (45.23) | $X^2 = 6.321$ |
| | ≥3 year | 470 | 246 (52.34) | P = 0.04 |
| Locality | Bund Bosan | 200 | 34 (17.00) | |
| | Shahruknealam | 200 | 160 (80.00) | |
| | Shershah | 200 | 40 (20.00) | |
| | Musapak shaheed | 200 | 110 (55.0) | |
| | Shujaabad | 200 | 100 (50.0) | $X^2 = 246.84$ |
| | Jalalpur | 200 | 130 (65.0) | P = 0.00 |
| Breed | Kajli | 58 | 29 (50.00) | |
| | Lohi | 679 | 345 (51.00) | |
| | Teddy | 127 | 50 (39.37) | |
| | Nacchi | 260 | 111 (42.69) | $X^2 = 9.616$ |
| | Beetal | 76 | 40 (52.63) | P = 0.04 |
| Season | Winter | 300 | 35 (11.66) | |
| | Spring | 300 | 150 (50,00) | |
| | Summer | 300 | 233 (77.66) | $X^2 = 264.29$ |
| | Autumn | 300 | 157 (52.33) | P = 0.00 |

The higher tick prevalence in goats compared to present study may endorseddue to difference of climatic geographical factors, goats breed and genetic resistance to ticks in the studied animals. The tick species identified during present study depicted in figure 1. *Hylomma anatolicum* was the dominant tick species 300 (52.17%) followed by and *Rhipicephalus sanguineus* 100 (17.39%) in the surveyed animals.

The mixed infection of both tick species was found 175 (30.43%) in small ruminants as summarized in table 1.

Among sheep *Hylomma anatolicum* accounts for 195 (26.45%) followed by *Rhipicephalus sanguineus* 65 (8.81%) where as mixed infestation of both tick species was observed 113 (15.33%) while in goats *Hylomma anatolicum* were reported 104 (22.46%) followed by *Rhipicephalus sanguineus* 35 (7.55%) where as mixed infestation was observed 62 (13.39%) as indicated in Figure 2.

The prevalence of tick infestation was found statistically significant (P<0.05) in different age groups and breed of animal but gender wise tick prevalence found non significant as stated in table 2.Significantly (P<0.05) higher tick infestation (52.3%) was found in older animals of age >3 years followed by (45.23%) in animals of age 1-2 years and lower 44.0% in animals of age <1 year.

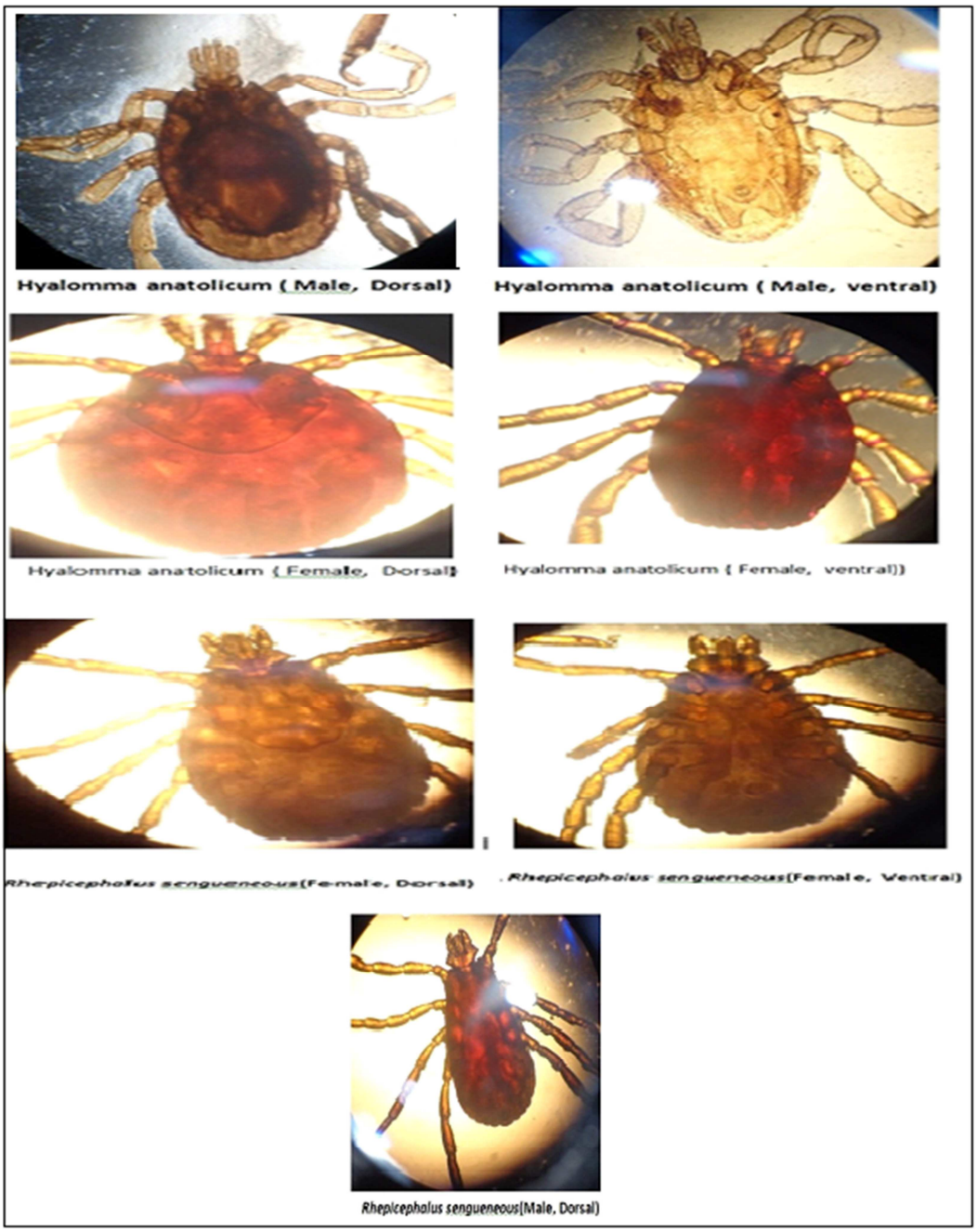



**Fig. 1.** Tick species identified during current study

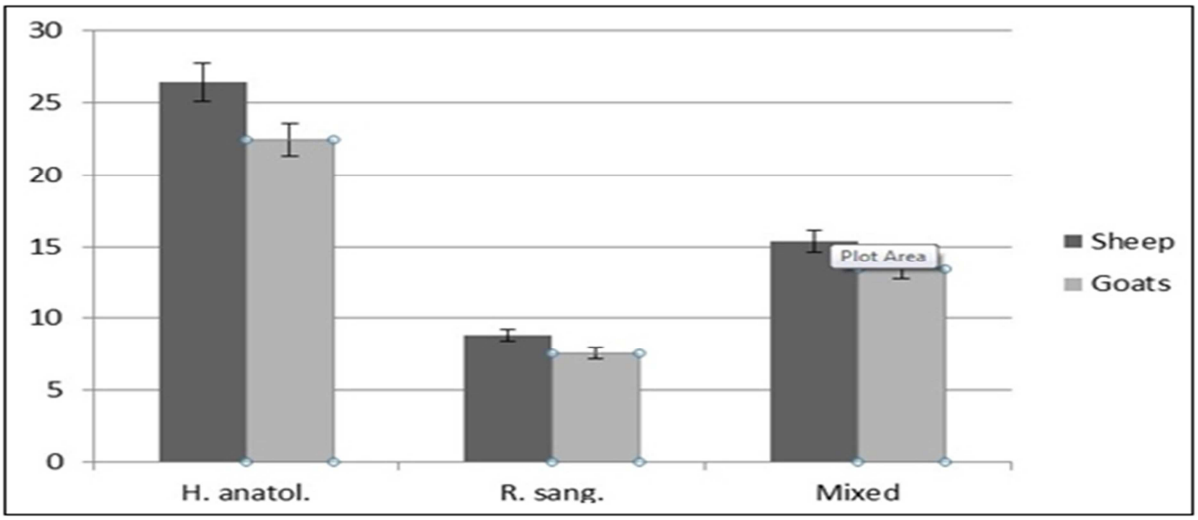



**Fig. 2.** Specie wise tick prevalence in sheep and goats.

The results of present study were in line with those of Sertse (2007) and Desalegn *et al.* (2015) who reported higher tick infestation in age groups greater than 3 years compared to lower age animals in domestic ruminants. The higher tick infestation in older animals may be attributed to long distant animal' s movement to pursuit food and water, so the chance of tick infestation higher during this period (Teseema and Gashaw, 2010). Our results contradicts to the findings of Sajid *et al.* (2011) who reported greater exposure of young animal to tick infestation might be endorsed due to reduced behavioral activities. Moreover, acquired immunity produced with age and thicker skin of old age animals can also support to resistance against tick burden in older age animals (Obi *et al.,* 2014).

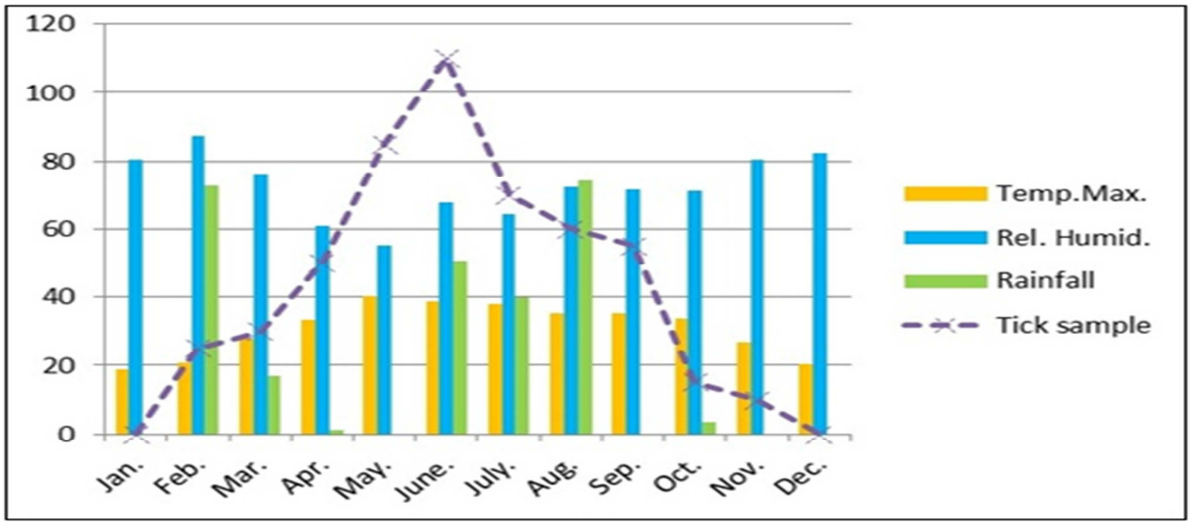



**Fig. 3.** Correlation between prevalence of Tick prevalence and weather parameters in sheep and goats of district Multan, southern Punjab, Pakistan.

The prevalence of *H. anatolicum* was recorded higher in all age groups of small ruminants <1 year, 1-2 year and >3 year i.e. 50.34%, 55.31% and 51.04% respectively. The *R. sanguineus* infestation was found higher in age group 1-2 year (30.82%) followed by age group ≤1 year (21.08%) and lower in age group ≥3 year (13.57%). The mixed infection of both species was recorded higher in age group >3 year (31.38%),

followed by age group 1-2 year (30.82%) and age group <1 year (28.57%) as depicted in figure 7.

The breed-wise prevalence of ticks was found significant (P<0.05) between different breeds of small ruminants. Among sheep the highest prevalence was in Lohi breed (51.0%) than Kajli breed (50.0%) while in goats highest tick infestation was reported in Beetal breed (52.6%), followed Nachi breed (42.7%), and Teddy breed (39.2%) as stated in table 2.Similar to our results Sajid *et al.,* (2011) found higher tick prevalence in Teddy breed (78.9%) followed by Beetal breed (67.0%), cross-bred breed (60.8%), Nacchi breed (56.9%) and lower in Dira Din Pannah (DDP) breed (38.5%) in goats. The difference of tick infestation among different breeds of goats could be due to difference of genetic resistance in different breeds and climatic conditions of the studied area (Jongejan and Uilenberg, 2004). However, the factors involved to become more susceptible to ticks bites need to be identified in Pakistan.

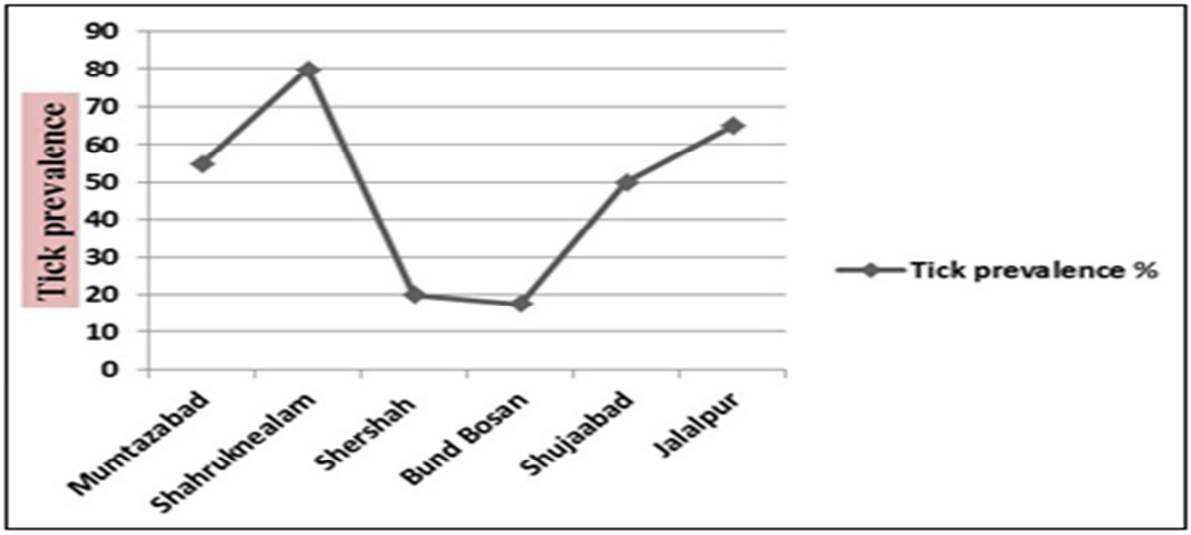



**Fig. 4.** Townwise tick prevalence in sheep and goats in district Multan, Punjab, Pakistan.

The prevalence of tick infestation found higher in females (48.5%) than males (45.2%) but the association between gender and tick prevalence in overall small ruminants was found non significant (P>0.05). In sheep the tick infestation recorded higher in females (51 %) followed by males (50%) while in goats males were found highly infested (46.5 %) as compared to females (42.5%). The results of present study are in agreement to Yakhchali and Hosseine (2006) who reported higher tick infestation (78.1%) in females than in males 21.9% in small ruminants in Iran. Higher secretion of prolactin and progesterone in females made them more susceptible to tick bites than males reported by Lioyd (1983) and Rony *et al.* (2010). The difference of tick prevalence in female can be hypothesized due to confinement of females either during lactation or gestation, which make them less active, low immunity and hormonal impacts may be related to higher susceptibility of tick bites in females as stated by Urquhart *et al.* (2001).

The month and season wise prevalence was determined in present study. The ticks started to appear by the start of Feburary and highly active from end of April to August (Figure 3).

The higher tick prevalence was recorded in June (81.00%) while lower in November (35.00%). The statistical analysis has showed significant differences (P<0.05) in the prevalence of tick infestation in different months.

These results were in line with Atif *et al.* (2012); Manan *et al.*, 2007 and Mustafa *et al.* (2014) who reported the higher tick prevalence from June to

August and lowest in November and February might be validated due temperature difference and humidity throughout the year. Higher tick prevalence was found in summer season (77.7%) followed by autumn season (52.3%), spring season (50%) and lowest in winter season (11.1%). The results were in line with the findings of Rony *et al.* (2010), Abadi *et al.* (2010) and Kabir *et al.* (2011) who recorded higher tick infestation in summer season followed by winter and rainy season due to higher temperature in summer season favorable for tick bites.

Although the different towns of district Multan lies in the same agroecological zone, the higher tick infestation was recorded in Shahruknealam Town (80%), followed by Jalal pur Town (65%), Mumtazabad Town (55%), Shujaabad Town (50%), Sher shah Town (20%) and Bundbosan Town (17.50%).

The statistical analysis has showed significant differences ($P<0.05$) in the prevalence of tick infestation in different towns of district Multan, Punjab Province, Pakistan as depicted in figure 4.
Various body sites of small ruminants (sheep and goats) were determined in order to rank the predilection sites of ticks. It was found that in sheep internal ear (94%) and external ear (80%) were the most infested sites followed by back (10%), inner thighs (9%), external genitals (8%), eyes (7%) flanks (4%), legs and tail (3% each).

In goats internal ear (95%) were the most infested sites of tick infestation followed by external ear (20%), external genitalis (10%), eyes (5%), inner thighs (4%), flanks, legs and tail (2% each) as shown in figure 5. Similar results of predilection sites of ticks were found Sajid *et al.* (2011) in sheep and goats.

The ears of the animals compared to other body parts are preferable for ticks to reside and feed blood meal from host animal (Sajid *et al.*, 2007). Soft and pliable skin of young small ruminants enables tick bites and helpful to extend duration of attachment to the host.

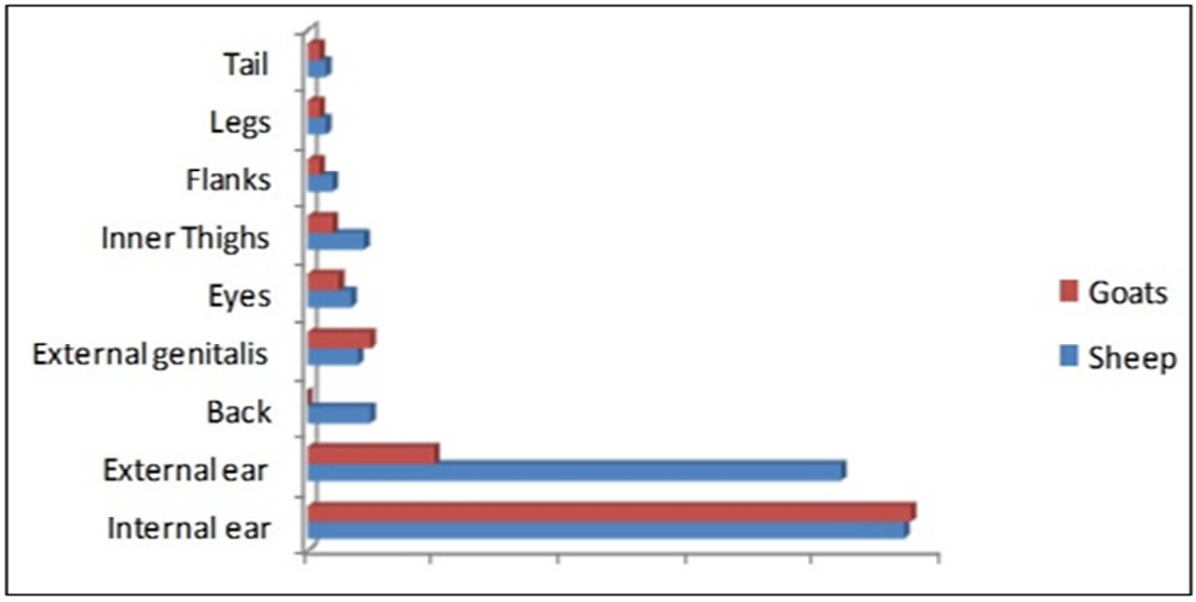



**Fig. 5.** predilection sites of ticks on different body parts of small ruminants (sheep and goats).

The higher tick infestation around ears in small ruminants might be endorsed that ticks frequently choose thinner and dumpy hair skin for infestation which benefits for easy penetration of tick's mouthparts into the feeding areas of the animals body which are richly supplied with blood vessels reported by Rehman *et al.* (2010).

Our results was in agreement to the findings of Jongejan and Uilenberg, (2004) and Kabir *et al.*, 2011) who observed that ears, neck and dorsal floor frequently infested by ticks due to richly supplied blood capillaries to these areas.

**Conclusions**

In the present study two tick species *Hylomma anatolicum* and *Rhipicephalus sanguineus* were identified. The abundant tick species was *Hylomma anatolicum* in the study area.

The tick prevalence was statistically significant within month, season of year, age and breed of animals. Generally ticks are highly prevalent in this study area due to poor veterinary services, auspicious geoclimatic circumstances and poor cognizance of owners to damages due to tick infestation in the study area. Therefore, attention should be given to the control and prevention of tick infestation.

**Acknowledgements**

This manuscript is a part of my Ph. D. dissertation funded by the Higher Education Commission, Islamabad, Pakistan under 5000 Ph.D Fellowship Scheme Phase IV. Authors would like to thank all the veterinarians for their kind help during sample collection.

*Author's contribution*

Survey, tick sample collection, the experimental work in the laboratory i.e. tick processing, permanent mounts of ticks in canada balsam were performed by Muhammad Riaz and the compilation of results were performed by Muhammad Riaz and Muhammad Zakaullah while the manuscript was critically analyzed and reviewed by Prof. Dr. Zahida Tasawar.

**Conflict of interest**

It is declared that there is no conflict of interest between the authors.

**References**

**Abadi YS, Telmadarraiy Z, Vatandoost H, Chinikar HC, Oshaghi1 MA, Moradi M,Ardakan EM, Hekmat S, Nasiri A.** 2010. Hard Ticks on Domestic Ruminants and their Seasonal Population Dynamics in Yazd Province, Iran. Iranian Journal of Arthropod-Borne Diseases **4,** 66–71.

**Ahmad J, Alp H, Askin M, Seitzer U.** 2007. Current status of ticks in Asia. Parasitological Research **102,** 159-162.

**Atif FA, Khan MS, Iqbal HJ, Roheen T.** 2012. Prevalence of tick-born disease in Punjab (Pakistan) and hematological profile on *Anaplasmama rginale* infection in indigenous and crossbred cattle. Pakistan Journal of Science **4,** 11-15.

**De Castro, James JAD, Minjauw BD, Giulio GU, Permin A, Pegram RG, Chizyuka HG, Sinyangwe P.** 1997. Long-term studies on the economic impact of ticks on Sanga cattle in Zambia. Experimental Applied Acarology **21,** 3-19.

**Desalegn T, Fikru A, Kasaye S.** 2015. Survey of Tick Infestation in Domestic Ruminants of Haramaya District, Eastern Hararghe, Ethiopia. Journal of Bacteriology and Parasitology **6,** 246-49.

**Ghosh S, Bansal GC, Gupta C, Ray D, Khan MQ, Irshad H, Shahiduzzaman M, Seitzer U. Ahmed JS.** 2007. Status of tick distribution in Bangladesh, India and Pakistan. Parasitological Research**101**, 207-216.

**Hussain SI.** 1980.Studies on ectopara sites of livestock of Sindh. Final technical report, University of Sindh, Pakistan. pp. 80-120.

**Iqbal F, Khattak RM, Ozubek S, Khattak MNK, Rasul A, Aktas M.** 2013. Application of the Reverse Line Blot Assay for the molecular detection of *Theileria* and *Babesia* spp. in sheep and goats blood samples from Pakistan. Iranian Journal of Parasitology **8**, 289-295.

**Irshad N, Qayyum M, Hussain M, Khan MQ.** 2010. Prevalence of tick infestation and theileriosis in sheep and goats. Pakistan Veterinary Journal **30,** 178-180.

**Jongejan F, Uilenberg G.** 1994. Ticks and control methods. Revue Scientifiqueet Technique Intternal office of Epizootics **13,** 1201-1226.

**Jonsson NN, Mayer DG, Matschoss AL, Green PE, Ansell J.** 1998. Production effects of cattle tick (*Boophilus microplus*) infestation of high yielding dairy cows. Veterinary Parasitology **78,** 65-77.

**Kabir MHB, Mondal MMH, Eliyas M, Mannan MA, Hashem MA, Debnath NC, Miazi OF, Mohiuddin C, Kashem MA, Islam MR, Elahi MF.** 2011. An epidemiological survey on investigation of tick infestation in cattle at Chittagong District, Bangladesh. African Journal of Microbiological Research **5,** 346-352.

**Kakar MN, Kakarsulemankhel JK.** 2008. Prevalence of endo (Trematodes) and ecto-parasites in cows and buffaloes of Quetta, Pakistan. Pakistan Veterinary Journal **28,** 34–36.

**Khan MN, Iqbal Z, Hayat CS.** 1998**.** Evaluation of acaricidal efficacy ofIvermectin, Diazinon, Permethrin and Coumaphos in sheep and goats. Pakistan Journal of Biological Science **1,** 63-65.

**Khan MN, Hayat CS, Iqbal Z, Hayat B, Naseem A.** 1993. Prevalence of ticks on livestock in Faisalabad Pakistan. Pakistan Veterinary Journal **13,** 182–184.

**Lloyd DH.** 2004. Mites and ticks of domestic animals. An identification guide and information source. Veterinary Dermatology**15,** 266-269.

**Manan A, Khan Z, Ahmad B, Abdullah M.** 2007. Prevalence and identification of *Ixodid* tick genera in frontier region Peshawar. Journal of Agricultural Biological Science **2,** 21-25.

**Mulugeta Y, Yacob TH, Ashenafi H.** 2010**.** Ectoparasites of small ruminants in three agro-ecolopgical selected sites of Tigray Region, Ethiopia. Tropical Animal Health Production **42,** 1219- 1224.

**Mustafa I, Shabir RMK, Subhani M, Ahmad I,Raza A, Jamil S, Muqaddas H, Shabir RG,Ghani A, Mahmood T, Aslam M, Khan MR,Asif S, Malik IU, Raza AM, Aqeel M A, Qayyum M, Waqas A, Ahmed H.** 2014. Seasonal Activity of Tick Infestation in Goats and Buffalo of Punjab Province (District Sargodha), Pakistan. Turkiye Parazitologi Dergisi **20,** 655-662.

**Obi ZC, Lucy A, Orji MN.** 2014. Ectoparasitosis, a challenge in sheep and goat production in ULI, Anambra state, Nigeria. International Journal of Faundamental and Bioiological Studies **1,** 27-29.

**Rasul G, Akhtar AS.** 1975. Survey of hard ticks of livestock in Pakistan. Pakistan Journal of Animal Sciences **1,** 7-11,

**Rehman ZU, Khan MS,Awais M, Aleem M, Shabbir MZ, Khan JA.** 2010. Prevalence of theileriosis in sheep in Okara district, Pakistan. Pakistan Journal of Zoology **42,** 639-643.

**Rony SA, Mondal MMH, Begum N, Islam MA, Affroze S.** 2010. Epidemiology of ectoparasiticinfestationsin cattle at Bhawal forest area, Gazipur. Bangladesh Journal of Veterinary Medicine **8,** 27 – 33.

**Sajid MS, Iqbal Z, Khan MN, Muhammad G.** 2008**.** Point Prevalence of hard ticks infesting domestic ruminants of lower Punjab, Pakistan. International Journal of Agricultural Biology **10,** 349-51.

**Sajid MS, Iqbal Z, Khan MN, Muhammad G, Iqbal MU.** 2007. Effect of Hyalomma ticks (Acari: Ixodidae) on milk production of dairy buffaloes (Bos Bubalus Bubalis) of Punjab (Pakistan). Italian Journal of Animal Sciences **6,** 39-45.

**Sajid MS, Iqbal Z, Khan MN, Muhammad G, Needham G, Khan MK.** 2011. Prevalence, associated determinants, and in vivo chemotherapeutic control of hard ticks (Acari: Ixodidae) infesting domestic goats (*Capra hircus*) of lower Punjab, Pakistan. Parasitology Research **3,** 601–609.

**Sertse T, Wossene A.** 2007. A study on ectoparasites of sheep and goats in eastern part of Amhara region, North east Ethiopia. Small Ruminant Research **69,** 62-67.

**Tesfaye D, Assefa M, Demissie T, Taye M.** 2012. Ectoparasites of small ruminants presented at Bahir Dar Veterinary Clinic, Northwest Ethiopia. African Journal of Agriculture Research **7,** 4669–4674.

**Tessema T, Gashaw A.** 2010. Prevalence of ticks on local and crossbreed cattle in and around Asela Town, South East, Ethiopia, Amber Animal Health Department, East Gojam. Ethiopian Veterinary Journal **14,** 79-89.

**Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW.** 1996. Veterinary Parasitilogy. 2nd ed. Blackwell Science Ltd, Oxford, London, Edinburg, 246-249 P.

**Walker RA, Butiur S, Estrada-Peña A, Hora A, Latif G, Pergam A, Preston P.** 2003. Tick of Domestic Animal in Africa, Guide to Identification Tick Species, 3-210 P.

**Yagoub KA, Abakar AD, Bashar AA, Mohammed SM.** 2014. Ticks (Acari: Ixodidae) infesting sheep and goats in nyalatown, South Darfur, Sudan. Sudan University of sicence and technology Journal of Agriculture and Veterinary Science **16,** 21-30.

**Yakhchali M, Hosseini A.** 2006. Prevalence and ectoparasites fauna of sheep andgoats flocks in Urmia suburb, Iranian Veterinaria rskiarhiv **76,** 431–442,.

J. Bio. Env. Sci. | 2017

ISSN 2220-6663 (Print)
ISSN 2222-3045 (Online)

JBES
Journal of Biodiversity and Environmental Sciences

Volume 10, Number 3, March 2017

JBES ©
Off Print

INNSPUB
International Network For Natural Sciences
Website: www.innspub.net