



RESEARCH ARTICLE

Prevalence of Tick Infestation in Farm Animals from Punjab, Pakistan

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ABSTRACT

Ticks are the second to mosquitoes as vectors of a number of pathogens like viruses, spirochetes, bacteria, rickettsia, protozoa and filarial nematodes etc. that cause mortality in humans and animals. So, this study was carried out to check the prevalence of ticks in Punjab, Pakistan. The total 120 livestock farms were randomly selected from 12 districts of Punjab, 10 farms (05 urban and 05 rural) from each district. Tick species were collected systematically from head to tail directions with the help of small steel forceps. Then tick samples were taken to the research laboratory and were preserved in 70% methanol for identification. On the basis of morphology, the collected ticks were distinguished microscopically with the help of the dichotomous key. The prevalence of ticks was significantly less in the Northern zone (33.47%) as compared to the Southern (36.33%), Western (35.83%) and Central zones (40.43%). The total nine tick species i.e. *Hylomma* (*Hy.*) *anatolicum* (26.39%), *Hy. marginatum* (14.51%), *Hy. dromedarii* (5.62%), *Hy. truncatum* (2.45%), *Hy. rufipes* (1.81%), *Rhipicephalus* (*Rh.*) *sanguineus* (17.24%), *Rh. appendiculatus* (12.39%), *Rh. microplus* (14.24%) and *Rh. decoloratus* (5.35%) were identified. In all selected zones, *Hy. anatolicum* was the most abundant tick's species. The overall prevalence of ticks infestation in all animals were 36.52% and it was significantly different in all animal species, like buffaloes (37.53%), cows (42.41%), goats (36.14%) and sheep (29.00%). It was concluded that there is wider variety of ticks in Pakistan.

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INTRODUCTION

Pakistan is an agricultural country with 75% of its population involved directly or indirectly with the agriculture sector. It is the 2nd larger sector that provides 21.2% contribution as GDP (Gross Domestic Production) by providing employment to 45% of the workforce. Majority of its population (>70%) lives in villages and generally depends on the rearing of animals for their livelihood (Mather and Abdullah, 2015). Different types of domesticated animals such as buffaloes, cattle, goats, sheep, poultry, horses, donkeys and camel are included in livestock (Khan, 2004). Parasitic diseases are the major issues to the poor farming community in tropical and subtropical areas in particular Pakistan (Jonsson, 2006; Khan *et al.*, 2017; Mehmood *et al.*, 2017; Naqvi *et al.*, 2017; Zaman *et al.*, 2017; Abbas *et al.*, 2018; Khater *et al.*, 2018). Among ectoparasites, ticks are blood-sucking parasites associated with mammals, birds and reptiles

(Aslam *et al.*, 2015; Ali *et al.*, 2016) which, also transmit diseases in its host.

The distribution of ticks is cosmopolitan (Durrani *et al.*, 2008). Being a sub-tropical country, Pakistan provides optimum conditions for ticks growth and multiplication. But, very little research was done on tick taxonomy and tick infestation (Sajid *et al.*, 2008, 2009; Ali *et al.*, 2016). Several factors such as species, age, sex, season, breed, photoperiod and management are responsible to influence the receptiveness and resistance of animals to tick infestation (Asmaa *et al.*, 2014). Cracks and crevices in the floor and walls of animal shed, animal tethering and grazing were found bonded with a greater level of tick incidence (Iqbal *et al.*, 2013). Generally, ticks damage hidden parts of the animals and cause lower productivity and mortality. Over the past two decades, the occurrence of tick borne diseases have increased and caused health problems (Kaur *et al.*, 2015). Detrimental effects of ticks to animals are loss of blood, irritation, stress and despair

of the immune system. Due to the direct transmission of diseases into the host, ticks are highly responsible for economic losses in term of decreasing skin quality of cattle up to 20-30% (Sultana *et al.*, 2015).

Today, zoonotic pathogens are responsible for the most emerging infectious diseases, which are transmitted by tick vectors making ticks second to mosquitoes as vectors (Kaur *et al.*, 2015). Out of 700 species, 269 species of hard ticks are found to cause health-related problems in human beings (Otranto *et al.*, 2014) and Crimean-Congo hemorrhagic fever is one of them. This disease is transmitted to human beings through the bite of an infected adult *Hyalomma* ticks. This disease is increasing day by day in Pakistan, a total of 196 cases and 48 deaths were reported during 2012-2014 (WHO, 2014). Ticks also encompass a very strong veterinary problem as they spread diseases e.g. anaplasmosis, theileriosis, babesiosis, and trypanosomiasis and toxicosis (Kaur *et al.*, 2015). Contagious diseases are important contributors to mortality and disease in animals and humans (Jabbar *et al.*, 2015).

Thus, an effective and well planned work to examine the incidence and prevalence of ticks in the province of Punjab, Pakistan is need of the time (Durrani *et al.*, 2008). Most of the earlier research work was restricted to one district or a part of the district and no one consider agro-ecological zones and cropping pattern on a large scale that can also affect the ticks distribution and prevalence (Jabbar *et al.*, 2015). So, this project was planned to investigate the prevalence of ticks across different geographical zones of the Punjab Province.

MATERIALS AND METHODS

Study area: These research activities were performed in four agro-ecological zones of Punjab (Rehman *et al.*, 2017), Pakistan (Fig. 1), i.e., Southern zone (Muzaffargarh, Bahawalpur & Rajanpur), Western zone (Khushab, Bhakar & Layyah), Central zone (Jhang, Gujranwala & Faisalabad) and Northern zone (Rawalpindi, Attock & Chakwal) in four seasons, i.e., spring (February to April), summer (May to July), autumn (August to October) and winter (November to January) during 2016 & 17. In the study areas generally, the climate is dry and receives less than 200 mm of rainfall annually. There is a noticeable difference in the climate of Western and Central zone. Central and Northern zones are somewhat cooler than Southern and Western zones. Above cited four seasons are found in study areas and generally the temperature ranges from -2 to 45°C and can reach up to 50°C in summer and -5°C in winter. But during late summer, humidity increases that provide suitable conditions for tick infestation and multiplication. A total of 120 livestock farms were selected from 12 districts as mentioned above.

Collection and preservation of ticks: Ticks were collected from buffaloes, cows, goats and sheep. From each district, 10 livestock farms (05 urban and 05 rural) were randomly selected in such a way that each farm was at least 10km apart from the other farm in urban areas while in rural areas, each farm was selected from different villages that were at least 5km apart. The selected 5-10

animals were systematically observed from farms by close examination, parting the hairs against their natural direction for the recognition of ticks. Tick species were collected systematically from head to tail directions with the help of small steel forceps with blunt ends without damaging their mouth. Ticks were preserved in 70% methanol (Atif *et al.*, 2012) and carried to the laboratory in the Department of Zoology, Government College University, Faisalabad for the identification.

Identification of ticks: Identification of ticks was carried out with the help of the anatomical and morphological characteristics in the laboratory using dissecting and compound microscopes according to the keys given by McCarthy (1967) and Estrada-Pena *et al.* (2006). Moreover, species level was identified under a stereomicroscope (OPTICA SZM-1: Italy) with 40-fold magnification (Apanaskevich and Horak, 2005).

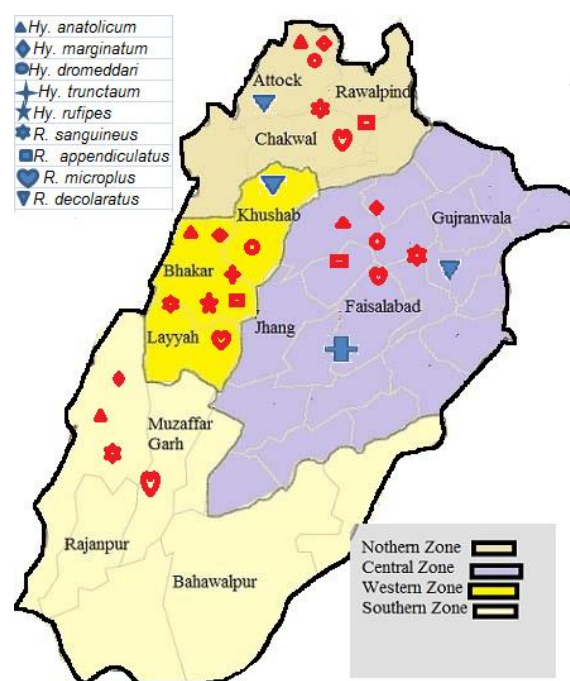


Fig. 1: Map of province Punjab showing the studied districts.

Statistical analysis: The prevalence of ticks was determined by using logistic regressions (Rehman *et al.*, 2017) and odd's ratio (OR) at 95% confidence interval (CI) in all studied agro-ecological zones of Punjab, Pakistan by using SPSS software package (SPSS, 21).

RESULTS

Total nine tick species i.e. *Hyalomma* (*Hy.*) *anatolicum*, *Hy. marginatum*, *Hy. dromedarii*, *Hy. truncatum*, *Hy. rufipes*, *Rhipicephalus* (*Rh.*) *sanguineus*, *Rh. appendiculatus*, *Rh. Microplus* and *Rh. decoloratus* were identified. In all selected zones, *Hy. anatolicum* and *Hy. marginatum* were the most abundant ticks species. The total prevalence of tick-infested animals was recorded at 36.52% (4382/12,000) in different districts of Punjab, Pakistan. The highest prevalence (40.43%) was observed from Central zone while the lowest (33.47%) from Northern zone and prevalence data for other zones was

shown in Table 1. The non-significant ($P>0.05$) differences were observed in Western zone while significant ($P<0.05$) differences in Southern zone and the highly significant ($P<0.001$) differences in Central zone.

During the present study, a total of 12,000 animals i.e. 3200 buffaloes, 3200 cows, 2800 goats and 2800 sheep were randomly examined for tick collection. Out of 12,000 animals, 4382/12,000 (36.52%) animals were observed infested with ticks. The highly significant ($P<0.001$) differences were observed in the prevalence of all ruminants. The prevalence of ticks in buffaloes, cows, goats and sheep were detected (37.53, 42.41, 36.14 and 29.00%), respectively as described in Table 2.

Table 3 is showing season-wise (prevalence %) for overall data. The highly significant ($P<0.001$) differences were observed in the prevalence of ticks in all different seasons. During this study, the highest prevalence was observed in summer (55.87%) followed by spring (41.30%), autumn (29.57%) and lowest during winter seasons (19.33%).

Ruminants including buffaloes, cows, sheep and goats were observed infested with different tick species, from four agro-ecological zones of Punjab. From all genera, *Hy. anatolicum* (26.39%) was the most common species in all four zones followed by *Rh. sanguineus* (17.24%) and *Rh. microplus* (14.24%) while the least common was *Hy. rufipes* (1.81%). In all zones, *Hy. Marginatum* was the second common tick species in ruminants except sheep while *Hy. Dromedarii* were present in all zones except Northern zone. It was observed that *Hy. truncatum* and *Hy. rufipes* were present only in

Western zone and absent in Southern, Central and Northern zones of Punjab, Pakistan (Table 1). Similarly, *Rh. sanguineus* and *Rh. microplus* both were present in all regions (central, western, southern and northern regions) while *Rh. appendiculatus* and *Rh. decoloratus* were observed in three zones and were not observed in Northern zone.

DISCUSSION

Ticks are the most important pest of livestock in tropical and subtropical regions of the world (Admassu *et al.*, 2015). The results of the current research showed the presence of one or multiple tick species from all the observed livestock farms. Variations were present in the prevalence of ticks infestation within farms of same study areas. The prevalence of ticks in Western, Central, Southern and Northern zones was recorded 35.83, 40.43, 36.33 and 33.47%, respectively. These variations in tick prevalence were due to the geographical condition, temperature and climatic conditions of different study area of Province, Punjab (Iqbal *et al.*, 2014). The previous studies on tick prevalence were centred on a specific area or different parts of the same region (Iqbal *et al.*, 2013) only instead of agro-ecological regions (Jabbar *et al.*, 2015). The data regarding the prevalence of ticks in various species of animals were observed during different seasons of the year. The results of the current study revealed the highest prevalence of tick infestation in summer because in summer the weather was hot and humid which supported the survival of tick infestation.

Table 1: Prevalence of identified tick species in different zones from Punjab, Pakistan

Ticks species	Central Zone	Western Zone	Southern Zone	Northern Zone
	NAE/NAI/NTC	NAE/NAI/NTC	NAE/NAI/NTC	NAE/NAI/NTC
	3000/1213/5220	3000/1075/8682	3000/1090/5120	3000/1004/2716
Tick Prevalence	40.43% ($P<0.001$)	35.83% ($P=0.054$)	36.33% ($P=0.020$)	33.47% ($P=0.035$)
<i>Hy. anatolicum</i>	21.63% (1241)	36.64% (2102)	24.23% (1390)	17.50% (1003)
<i>Hy. marginatum</i>	21.68% (684)	28.81% (909)	30.18% (952)	19.33% (609)
<i>Hy. dromedarii</i>	32.81% (401)	38.21% (467)	28.96% (354)	0
<i>Hy. truncatum</i>	0	100% (532)	0	0
<i>Hy. rufipes</i>	0	100% (393)	0	0
<i>Rh. sanguineus</i>	26.19% (982)	43.43% (1628)	21.28% (797)	9.10% (341)
<i>Rh. appendiculatus</i>	29.84% (804)	47.99% (1293)	22.16% (597)	0
<i>Rh. microplus</i>	22.97% (711)	29.43% (912)	22.95% (710)	24.65% (763)
<i>Rh. decoloratus</i>	34.08% (397)	38.38% (446)	27.54% (320)	0

NAE= Number of animals examined, NAI= Number of animals infested, NTC= Number of ticks collected.

Table 2: Prevalence of identified tick species in different farm animals in Punjab, Pakistan

Ticks species	Buffaloes	Cows	Goats	Sheep	Tick species (%)
	NAE/NAI/NTC	NAE/NAI/NTC	NAE/NAI/NTC	NAE/NAI/NTC	
	3200/1201/4855	3200/1357/7274	2800/1012/6207	2800/812/3402	
Tick Prevalence	37.53% ($P<0.001$)	42.41% ($P<0.001$)	36.14% ($P<0.001$)	29.00% ($P<0.001$)	
<i>Hy. anatolicum</i>	1183	2109	1518	926	26.39
<i>Hy. marginatum</i>	812	1318	1024	0	14.51
<i>Hy. dromedarii</i>	333	310	579	0	5.62
<i>Hy. truncatum</i>	178	354	0	0	2.45
<i>Hy. rufipes</i>	193	200	0	0	1.81
<i>Rh. sanguineus</i>	799	1214	989	746	17.24
<i>Rh. appendiculatus</i>	626	846	838	384	12.39
<i>Rh. microplus</i>	590	657	944	905	14.24
<i>Rh. decoloratus</i>	141	266	315	441	5.35

NAE= Number of animals examined, NAI= Number of animals infested, NTC= Number of ticks collected.

Table 3: Season-wise prevalence (%) of ticks from Punjab

Season	Total	Infected	Prevalence (%)	Odds Ratio	Confidence Interval 95%		P-value
					Lower limit	Upper limit	
Spring	3000	1239	41.30	2.936	2.614	3.297	<0.001
Summer	3000	1676	55.87	5.282	4.704	5.930	<0.001
Autumn	3000	887	29.57	1.752	1.554	1.974	<0.001
Winter	3000	580	19.33				

($P<0.05$) significant.

These results are at par with the results of Ghosh *et al.* (2007), Durrani and Shakoori (2009), Rony *et al.* (2010), Sultana *et al.* (2015) and Ali *et al.* (2016) who also noted high infestation of ticks in Summer. However, the animals remained infested with ticks all over the year. Variation in the infestation of the tick may be due to geographical positions and climatic conditions of different study areas. Different environmental factors including rainfall, temperature and moisture support the existence of tick in any area (Greenfield *et al.*, 2011), some other factors like season, availability of host status of nutrition in animals (Alonso *et al.*, 2007; Yacob *et al.*, 2008) and farming practices (Sajid *et al.*, 2011) also affect ticks infestation ratio. The results of our research were similar with that of Mustafa *et al.* (2014) who also noted high tick prevalence in the hot months (June to August) and Atif *et al.* (2012) who reported the highest infestation of ticks in the months of June and July in the study areas of Sargodha district Punjab, Pakistan. The findings of the present research were also in line with the findings of Kabir *et al.* (2011) who noted the higher prevalence of ticks in summer season (41.66%) followed by winter (31.5%) in Bangladesh.

The current study had been conducted in four seasons in different agro-ecological areas of Punjab to examine the prevalence of ticks in animals. The prevalence findings of our research were in line with the findings of Iqbal *et al.* (2013) who noted 31% prevalence of tick species from Pakistan. However, the prevalence results of this study were in contrast with the results of Mustafa *et al.* (2014) who reported 85% in Sargodha district Punjab, Pakistan. This difference in the prevalence of ticks may be due to the variation in climatic and geographical situations of the study zones, study periods, target populations and farming practices (Iqbal *et al.*, 2014). Prevalence of ticks in animals was abundant in Africa and Asia. A higher infestation of tick in these continents is due to the warmer climate which provides favourable conditions for the development of ticks, variation in housing styles, husbandry practices and strategies for tick control. It was reported that in last few years, the ticks' prevalence in the province Punjab had been increasing rapidly which could be due to the resistance of acaricides (Sajid *et al.*, 2008, 2009; Ali *et al.*, 2013; Mustafa *et al.*, 2014). The prevalence was considerably higher in the Central region in the current study due to high temperature that offered optimum situations for the multiplication of tick than the Northern region where the temperature was low. The results showed that the prevalence of tick infestation was associated with animal species, season and study area. The highest prevalence was found in summer followed by spring, autumn and winter seasons.

During our research, we collected ticks from 120 livestock farms from 12 districts of Punjab, Pakistan. We found 9 tick species from three genera, i. e., two hard genera (*Hyalomma* & *Rhipicephalus*). Most of the ticks were found from buffalo during the summer season. Tick infestation was high in the central zone of Punjab, Pakistan. *Hyalomma* species are the vectors of most of the diseases found in animals and man. Most of the *Hyalomma* ticks were recorded from the Western zone, so here is more danger of diseases. Farmers should treat their animals to kill ticks before transporting their animals to

other parts of the country to spread of transmission of ticks and tick borne diseases.

Authors contribution: SN, MB & IY designed the study and wrote the manuscript, AR and MY edited the manuscript.

REFERENCES

- Abbas A, Abbas RZ, Masood S, *et al.*, 2018. Acaricidal and insecticidal effects of essential oils against ectoparasites of veterinary importance. *Boletín Latinoamericano Y Del Caribe De Plantas Medicinales Y Aromáticas* 17:441-452.
- Admassu B, Yeneneh H, Shite A, *et al.*, 2015. Prevalence and identification of major Ixodid tick genera of cattle in Dangila district, Awi Zone, North West Ethiopia. *Acta Parasitol Globalis* 6:129-35.
- Ali S, Ijaz M, Durrani AZ, *et al.*, 2016. Epidemiological aspects of bovine tick infestation in the river Ravi region, Lahore. *Pak J Zool* 48:563-7.
- Alonso DMA, Lopez SB, Leme DLAC, *et al.*, 2007. Infestacion natural de hembras de *Boophilusmicroplus* Canestrini, 1887 (Acari: Ixodidae) en dos genotipos de bovinos en el tropicohumedo de Veracruz, Mexico. *Vet Mexico* 38:503-9.
- Apanaskevich D and Horak I, 2005. The genus *Hyalomma* Koch, 1844. II. Taxonomic status of *H. (Euhyalomma) anatolicum* Koch, 1844 and *H. (e.) excavatum* Koch, 1844 (Acari, Ixodidae) with redescription of all stages. *Acarina* 13:181-97.
- Aslam B, Hussain I, Zahoor MA, *et al.*, 2015. Prevalence of *Borrelia anserinain* Argas ticks. *Pak J Zool* 47:1125-31.
- Asmaa NM, El Bably MA and Shokier KA, 2014. Studies on prevalence, risk indicators and control options for tick infestation in ruminants. *Beni-suef Univ J Basic Appl Chem* 3:68-73.
- Atif FA, Khan MS, Iqbal HJ, *et al.*, 2012. Prevalence of *Anaplasma marginale*, *Babesia bigemina* and *Theileria annulata* infections among cattle in Sargodha district, Pakistan. *African J Agric Res* 7:3302-7.
- Durrani AZ and Shakoori AR, 2009. Study on ecological growth conditions of cattle *Hyalomma* ticks in Punjab, Pakistan. *Iran J Parasitol* 4:19-25.
- Durrani AZ, Ahmad M, Ashraf M, *et al.*, 2008. Prevalence of theileriosis in buffaloes and detection through blood smear examination and Polymerase Chain Reaction test in district Lahore. *J Anim Plant Sci* 18:2-3.
- Estrada-Peña A, Bouattour A, Camicas JL, *et al.*, 2006. The known distribution and ecological preferences of the tick subgenus *Boophilus* (Acari: Ixodidae) in Africa and Latin America. *Exp Appl Acarol* 38:219-35.
- Greenfield BPJ, 2011. Environmental parameters affecting tick (*Ixodes ricinus*) distribution during the Summer season in Richmond Park, London. *Int J Stud Res* 4:140-8.
- Hanem FK, Ali AM, Abouelella GA, *et al.*, 2018. Toxicity and growth inhibition potential of vetiver, cinnamon, and lavender essential oil and their blends against larvae of the sheep blowfly, *Lucilia sericata*. *Int J Dermatol* 57:449-457.
- Iqbal A, Sajid MS, Khan MN, *et al.*, 2013. Frequency distribution of hard ticks (Acari: Ixodidae) infesting bubaline population of district Toba Tek Singh, Punjab, Pakistan. *Parasitol Res* 112:535-41.
- Iqbal A, Siddique F, Mahmood MS, *et al.*, 2014. Prevalence and impacts of ectoparasitic fauna infesting goats (*Capra hircus*) of district Toba Tek Singh, Punjab, Pakistan. *Global Vet* 12:158-64.
- Jabbar A, Abbas T, Sandhu ZUDU, *et al.*, 2015. Tick-borne diseases of bovines in Pakistan: major scope for future research and improved control. *Parasit Vectors* 8:283.
- Jonsson NN, 2006. The productivity effects of cattle tick infestation on cattle, with particular reference to *Bos indicus* cattle and their crosses. *Vet Parasitol* 137:1-10.
- Kabir MHB, Mondal MMH, Eliyas M, *et al.*, 2011. An epidemiological survey on investigation of tick infestation in cattle at Chittagong district, Bangladesh. *African J Microbiol Res* 5:346-52.
- Kaur D, Jaiswal K and Mishra S, 2015. Studies on Prevalence of ixodid ticks infesting cattle and their control by plant extracts. *J Pharm Biol Sci* 10:01-11.
- Khan AG, 2004. The characterization of the agro ecological context in which FAnGR (farm animal genetic resource) are found. Nairobi, Kenya: International Livestock Research Institute.

- Khan MN, Sajid MS, Rizwan HM, *et al.*, 2017. Comparative efficacy of six anthelmintic treatments against natural infection of fasciola species in sheep. *Pak Vet J* 37: 65-68.
- Mather TN and Abdullah GA, 2015. Building molecular biology capacity for preventing tick-transmitted diseases in Pakistan. *Pak-USA Sci Technol Coop Program* 11:23-15.
- McCarthy VC, 1967. *Ixodid Ticks (Acarina, Ixodidae) of West Pakistan*. University of Maryland.
- Mehmood KH, Zhang AJ, Sabir RZ, *et al.*, 2017. A review on epidemiology, global prevalence and economical losses of fasciolosis in ruminants. *Microb Path* 109: 253-62.
- Mustafa I, Shabbir RMK, Subhani M, *et al.*, 2014. Seasonal activity of tick infestation in goats and buffalo of Punjab Province (District Sargodha), Pakistan. *Kafkas Üniv Vet FakDerg* 20:655-62.
- Naqvi MAH, Khan MK, Iqbal Z, *et al.*, 2017. Prevalence and associated risk factors of haemoparasites, and their effects on hematological profile in domesticated chickens in District Layyah, Punjab, Pakistan. *Prev Vet Med* 143:49-53.
- Otranto D, Dantas-Torres F, Giannelli A, *et al.*, 2014. Ticks infesting humans in Italy and associated pathogens. *Parasit Vectors* 7:328.
- Rehman A, Nijhof AM, Sauter-Louis C, *et al.*, 2017. Distribution of ticks infesting ruminants and risk factors associated with high tick prevalence in livestock farms in the semiarid and arid agro-ecological zones of Pakistan. *Parasit Vectors* 10:190.
- Rony SA, Mondal MMH, Begum N, *et al.*, 2010. Epidemiology of ectoparasitic infestations in cattle at Bhawal forest area, Gazipur. *Bang. J Vet Med* 8:27-33.
- Sajid MS, Iqbal Z, Khan MKN, *et al.*, 2011. Prevalence, associated determinants, and in vivo chemotherapeutic control of hard ticks (Acari: Ixodidae) infesting domestic goats (*Capra hircus*) of lower Punjab, Pakistan. *Parasitol Res* 108:601-9.
- Sajid MS, Iqbal Z, Khan MN, *et al.*, 2008. Point prevalence of hard ticks (Ixodids) infesting domestic ruminants of lower Punjab, Pakistan. *Int J Agric Biol* 10:349-51.
- Sajid MS, Iqbal Z, Khan MN, *et al.*, 2009. In vitro and in vivo efficacies of Ivermectin and Cypermethrin against the cattle tick *Hyalomma anatolicum anatolicum* (Acari: Ixodidae). *Parasitol Res* 105:1133-8.
- Sultana N, Shamim A, Awan MS, *et al.*, 2015. First pilot study on the prevalence of tick infestation in livestock of tehsil Hajira, Rawalakot, Azad Kashmir. *Adv Anim Vet Sci* 3:430-4.
- WHO, 2014. Surveillance, forecasting and response: Cremean-Congo haemorrhagic fever in Pakistan. World Health Organization.
- Yacob HT, Atakly H and Kumsa B, 2008. Major ectoparasites of cattle in and around Mekelle, Northern Ethiopia. *Entomol Res* 38:126-30.
- Zaman MA, Rehman TU, Abbas RZ, *et al.*, 2017. Therapeutic potential of Ivermectin, doramectin and trichlorophan against *Psoroptes ovis* in sheep and cattle of Cholistan. *Pak Vet J* 37:233-35.