IJVAR

International Journal of Veterinary and Animal Research

Journal homepage: https://ijvar.org/index.php/ijvar

Prevalence and Risk Factors of Ectoparasite Infestation of Buffaloes from Coastal Regions of Bangladesh

Most. Aklima Khatun[1], Md. Shakil Hossain[2], S. M. Oli Ullah[3], Mahfuzul Islam[1], S. M. Abdullah[1]✉

[1]*Sher-e-Bangla Agricultural University, Department of Microbiology and Parasitology, Sher-e-Bangla Nagar, Dhaka, Bangladesh.*
[2]*Sher-e-Bangla Agricultural University, Faculty of Animal Science and Veterinary Medicine, Sher-e-Bangla Nagar, Dhaka, Bangladesh.*
[3]*Mawlana Bhashani Science and Technology University, Faculty of Veterinary Medicine and Animal Science, Santosh, Tangail, Bangladesh.*

ARTICLE INFO

Received: 26/11/2024
Accepted: 05/08/2025

DOI: 10.5281/zenodo.17068486

✉**Corresponding Author:** ab.sau.vet@gmail.com

Keywords

Bubalus bubalis
Lice
Occurrence
Seasonal influence
Ticks

Cite this article as: *Khatun M.A., Hossain Md. S., Ullah S. M. O., Islam M., Abdullah S. M. 2025. Prevalence and risk factors associated with ectoparasites infestation of buffalo in coastal regions of Bangladesh. International Journal of Veterinary and Animal Research, 8(2): 43-48. DOI: 10.5281/zenodo.17068486.*

ABSTRACT

Ectoparasitic infestation can bring a threat to cost-effective buffalo production by causing mechanical damage, including, irritation, anaemia, allergic reaction, loss of condition, and even death. The current study was aimed to determine the ectoparasite status of buffaloes in the coastal regions of Bangladesh. For this study, 270 buffaloes from three selected districts (Noakhali, Bhola and Bagerhat) were randomly selected and examined visually. Buffaloes from different sexes and age ranges were selected based on their availability, and several risk factors, such as season and management systems, were also considered for the current study. Four (4) species of ectoparasites, namely, *Haemaphysalis bispinosa*, *Rhipicephalus microplus*, *Linognathus vituli*, and *Damalinia bovis*, where 47, comprising at 17.41% of overall prevalence was documented among the study areas. In contrast to the species-wise prevalence, *H. bispinosa*, *R. microplus*, *L. vituli*, and *D. bovis* were detected in 26, 11, 3, and 7 buffaloes, comprising a prevalence of 9.63%, 4.07%, 1.11%, and 2.59%, respectively. Moreover, the highest prevalence (18.52%) was seen in the adult compared to young buffaloes (12.96%), and females (18.92%) were more likely to be infected than males (15.57%). In addition to this, seasonal variations in the presence of ectoparasites were observed, with Winter having the highest infection levels (28.89%), followed by Summer (16.67%), and Rainy (6.67%). The ectoparasites, encountered in this study, pose significant threats to public health due to their vector importance, therefore, necessitating regular monitoring and effective control measures should be implemented in this study area.

INTRODUCTION

Buffaloes, along with cattle, are imperative members of the family Bovidae, which include various species, of which water buffaloes are the most widely distributed throughout the world, with a population of 200 million (Borghese A, 2005; Minervino et al., 2020). There are currently 1.457 million buffalo in Bangladesh, which are reared for both personal subsistence and large-scale bathan farming in salty coastal regions. Moreover, buffalo are mostly employed as draft animals, however, they are also partially raised for milk and meat production (Hamid et al., 2016). Entities that live on the skin or skin surface, such as lice, ticks, mites, and fleas, are known as ectoparasites and can be extremely important in spreading certain infections (Sahito et al., 2017). For instance, a number of bacterial, viral, rickettsial, and protozoal infections are contaminated by ticks and mites (Apanaskevich et al., 2018). Ectoparasitic infestation can bring a threat to cost-effective buffalo production by causing mechanical damage, including, irritation, anemia, allergic reaction, loss of condition, and even death (Iqbal et al., 2014).

Among the ectoparasites, mites can cause severe losses, including rejecting skin, reduced production, anemia, and even death, when encountered in a good number (Arora and Arora, 2012; Sayyad et al., 2016). Mange mites have been linked to significant financial losses because of their harm to skin, anemia, poor physical health, slowed growth rates, and milk supply (Aatish et al., 2007). Moreover, ticks, one of the ectoparasites, have been known to pose a serious risk because of the diseases they can spread, including babesiosis, theileriosis, and anaplasmosis, as well as the allergic condition, extreme irritation, and tick toxicosis they can create in the host body (Sajid et al., 2008). In addition to this, ticks are important biological vectors of several disease-causing microbes, such as bacteria, viruses, rickettsia, and protozoans (Jongejan and Uilenberg, 2004), causing morbidity of buffaloes (Rony et al., 2010; Sultana et al., 2015). A good number of buffaloes reared in large-scale bathan farming are also affected by irritation, abscesses due to tick-bite, and severe blood loss which cause negative stressful effects on the animals (Manan et al., 2007). Furthermore, reduced hide quality can negatively impact the tanning industry and destroy a nation's Gross Domestic Products (GDP), are mostly caused by louse infestation, which affects the buffaloes raised under innumerable management systems to varying degrees (Green et al., 2001; Aatish et al., 2007; Shamim et al., 2015).

Different agroclimatic conditions, animal husbandry techniques, and pasture management largely impact the prevalence and intensity of various ectoparasitic conditions in a region. According to the literature, these factors would serve as a guideline for developing tactical and strategic control of these ectoparasites. In Bangladesh, very limited research has been conducted on the prevalence and the associated risk factors related to ectoparasites in buffaloes, especially in the southern areas. As a result, the current study was conducted to investigate the ectoparasite status of buffaloes in the southern areas of Bangladesh.

MATERIALS AND METHODS

Study areas and periods

Ectoparasites (ticks and lice) were carefully collected through the visual inspection by registered veterinarians from three selected districts due to the availability of buffaloes. These districts (Noakhali, Bhola and Bagerhat) are located in the southern parts of Bangladesh (Figure 1). Additionally, the Department of Livestock Services (DLS) verbally granted authorization for sampling, and all necessary processes were completed under the Animal Welfare Act of 2019. The cross-sectional study continued for one year comprising July 2023 to June 2024, where three predominant seasons, namely Rainy (July to October), Winter (November to February), and Summer (March to June) were covered by this study period. In each season, a single round of sampling from every study area was conducted, during which ectoparasites were collected from all selected animals within a short, fixed period to minimize temporal variation.

Sample size

270 buffaloes from the aforementioned locations were selected randomly and examined visually for this investigation. Based on their availability, buffaloes of different sexes or age ranges were chosen for the current investigation, where several risk factors, like season, managemental systems, etc. were also included. During sampling, 87 individuals were male and the rest 183 were female. Additionally, buffaloes were divided into two age groups: young (less than a year old) and adults (more than a year older), where the majority of the buffaloes were adults.

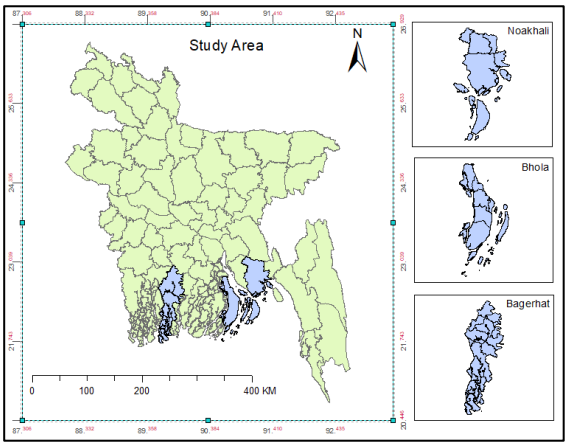

Figure 1. Location of study area

Sample size

270 buffaloes from the aforementioned locations were selected randomly and examined visually for this investigation. Based on their availability, buffaloes of different sexes or age ranges were chosen for the current investigation, where several risk factors, like season, managemental systems, etc. were also included. During sampling, 87 individuals were male and the rest 183 were female. Additionally, buffaloes were divided into two age groups: young (less than a year old) and adults (more than a year older), where the majority of the buffaloes were adults.

Collection of ectoparasites

Following proper confinement, the buffaloes were inspected in predetermined body parts (neck, ears, back, and tip of the tail), and any ectoparasites, especially, ticks and lice were removed subsequently from each animal. After being gathered, the ectoparasites were put into plastic tubes filled with 70% alcohol, and they were then morphologically recognized using particular traits (Soulsby E, 1982; Ruprah N, 1985; Wall and Shearer, 2008; Taylor et al., 2012; Mullen and Durden, 2018).

Processing of ectoparasites

The collected ectoparasites underwent a series of procedures, including dehydration, staining, and cleaning, before being slide mounted. First, the ectoparasites were made visible by allowing them to dissolve in 10% KOH for a whole night at room temperature. Following cleaning, the samples were put back into 50% ethanol and then into distilled water for 30 minutes each to get them ready for staining. The specimens were stained using Hematoxylin-Eosin (H & E) dye, and the slides were left in the stain for a whole night. By dipping the specimens in 3% Acid-Alcohol, the excess stain was eliminated as the specimens got darker. After that, the specimen was dehydrated into a series of ascending graded of ethanol for thirty minutes on each to complete this procedure. After dehydration, the samples were quickly cleaned with xylene and placed on a new slide having Canada balsam, and put a cover slip on

it. Then, the prepared slides were left for one to two days to become dry, and morphological identification of the ectoparasites was performed under a microscope (4X and/or 10X).

Statistical analysis

Data on individual buffalo were entered into MS-excel spread sheet program to create a database. Then the data was transferred to SPSS version 20 for further analysis. Prevalence of ectoparasites in relation to sex, age, season, and rearing system were analyzed using Chi-square statistical test, where $p<0.05$ was considered to be lest limit of significance.

RESULTS

Morphological identification of ectoparasites

A total of 270 buffaloes from three different districts were included in this study where ectoparasites were collected and observed under microscope for morphological identification through a proper scientific way. Four species of ectoparasites, namely, *Haemaphysalis bispinosa*, *Rhipicephalus microplus*, *Linognathus vituli*, and *Damalinia bovis*, were identified.

Overall prevalence of ectoparasites

Through a proper examination of the randomly selected buffaloes from study areas, a total of 47, comprising at 17.41% of overall prevalence was documented which indicated relatively low prevalence of ectoparasites. With respect to area-wise infestation, the highest prevalence was encountered in Noakhali (25.56%), followed by Bagerhat (16.67%), and Bhola (10.00%). The overall prevalence along with study areas were documented in Table 1.

Table 1. Overall prevalence of ectoparasites

Areas	No. of buffaloes examined	No. of buffaloes infected	Prevalence %	P-value
Noakhali	90	23	25.56	0.069
Bhola	90	09	10.00	
Bagerhat	90	15	16.67	
Total	**270**	**47**	**17.41**	

Species-wise prevalence of ectoparasites

A total of four ectoparasites in buffaloes were encountered in this study which is shown in Table 2. Among the examined buffaloes, *H. bispinosa*, *R. microplus*, *L. vituli*, and *D. bovis* were detected in 26, 11, 3, and 7 buffaloes, comprising 9.63%, 4.07%, 1.11%, and 2.59% of prevalence, respectively.

Table 2. Species-wise prevalence of ectoparasites

Species	No. of buffaloes infected (N=270)	Prevalence %	P-value
Haemaphysalis bispinosa	26	9.63	<0.001*
Rhipicephalus microplus	11	4.07	
Linognathus vituli	3	1.11	
Damalinia bovis	7	2.59	

'*'- indicates significance at <0.05

Age-wise prevalence of ectoparasites

During sampling, buffaloes were categorized into two age groups: young (<1 year) and adult (>1 year), with a larger proportion of adults included, as the adult buffaloes were more commonly available and accessible in the study areas. The prevalence of ectoparasites was higher in adult buffaloes (18.52%) compared to young ones (12.96%), as shown in Table 3. However, the difference was not statistically significant (p=0.412), indicating no strong association between age and ectoparasite infestation in the studied population.

Table 3. Age-wise prevalence of ectoparasites

Variables	No. of buffaloes examined	No. of buffaloes infected	Prevalence %	P-value
Young	54	7	12.96	0.412
Adult	216	40	18.52	

Gender-wise prevalence of ectoparasites

In relation to gender during sampling, 54.81% of the study population was female, and the remaining 45.19% was male buffalo. Regarding prevalence by gender, a slight difference was documented, where females (18.92%) were more likely to be infected than males (15.57%), although there was no significant association (p=0.544). The gender-wise prevalence is given in Table 4.

Table 4. Gender-wise prevalence of ectoparasites

Variables	No. of buffaloes examined	No. of buffaloes infected	Prevalence %	P-value
Male	122	19	15.57	0.544
Female	148	28	18.92	

Seasonal prevalence of ectoparasites

As we mentioned before, the cross-sectional study was continued for one year comprising three predominant seasons, namely Rainy (July to October), Winter (November to February), and Summer (March to June). Seasonal variations in the presence of ectoparasites were observed (Table 5), with the Winter having the highest infection levels (28.89%), followed by Summer (16.67%), and Rainy (6.67%). Statistical analysis revealed that these differences were significant (p=0.004), indicating a strong seasonal influence on ectoparasite prevalence.

Table 5. Seasonal prevalence of ectoparasites in buffaloes

Variables	No. of buffaloes examined	No. of buffaloes infected	Prevalence %	P-value
Summer	90	15	16.67	0.004*
Rainy	90	6	6.67	
Winter	90	26	28.89	

'*'- indicates significance at <0.05

Prevalence regarding management system

This study found that the buffaloes raised in a free-range system had a higher prevalence of ectoparasites (40.00%) than buffaloes raised in semi-intensive (28.57%) systems. However, this difference was not statistically significant (p=0.215), which is documented in Table 6.

Table 6: Prevalence regarding management system

Variables	No. of buffaloes examined	No. of buffaloes infected	Prevalence %	P-value
Free-range system	152	31	20.39	0.215
Semi-intensive system	118	16	13.55	

Regions of infestation by ectoparasites on buffaloes

After reviewing the literature, the body of buffaloes was identified to have five (5) main regions: the head with ears, the neck and chest region, the back with tail region, the abdomen, and the legs. A total of 134 ectoparasites were collected in this investigation, where most of the ectoparasites were detected from two regions, i.e., the head with ears, and the area surrounding the back and tail region. Conversely, the lowest percentage of tick availability was found in the neck and chest region. Table 7 showing the attachment of ectoparasites to the host's body was statistically significant (p=0.002), indicating a preference for certain attachment sites on the host body.

Table 7. Attachment of ectoparasites on the host's body

Attachment of ectoparasites	No. of ectoparasites counted	Prevalence %	P-value
Head with ears	42	31.34	0.002*
Neck and chest region	13	9.70	
Back with tail region	35	26.12	
Abdomen	24	17.91	
Legs	20	14.93	

'*'- indicates significance at <0.05

DISCUSSION AND CONCLUSION

Through the morphological identification, four species of ectoparasites, namely, *H. bispinosa*, *R. microplus*, *L. vituli*, and *D. bovis*, were identified according to the keys and descriptions of various authors. Among them, *D. bovis* was characterized by a rounded head, three-segmented antennae, and dark transverse abdominal bands, while *L. vituli* possessed piercing mouthparts, five-segmented antennae, and enlarged second and third pairs of legs (Rony et al., 2010; Kumsa et al., 2012). On the other hands, both ticks were morphologically distinguished by their shape of basis capituli and festoons. *H. bispinosa* exhibited a rectangular basis capitulum with 11 festoons on their posterior margin, whereas *R. microplus* had a hexagonal basis capitulum, lacking festoons (Makwarela et al., 2024; Hornok et al., 2025).

Moreover, a total of 47 buffaloes, comprising at 17.41% of overall prevalence was documented which indicated relatively low prevalence of ectoparasites. The findings of this study are very similar to the reports of Hussain et al. (2006), Kakar and Kakarsulemankhel (2008), and Batista et al. (2018), who reported a prevalence ranging of 18-30% from different parts of the world. However, Sajid et al. (2008), and Islam et al. (2009), found higher prevalence of ectoparasite from Pakistan and Bangladesh, respectively. The results of the current study may differ from those of previous studies due to the different geographic locations, climate of the experimental areas, study techniques including the methods of sampling, etc. (Rony et al., 2010). In addition to this, the identified ectoparasites was reported previously by various authors with a moderate prevalence (Islam et al., 2009; Rony et al., 2010). Furthermore, we found very lower prevalence of lice in buffalo, which may be associated with the wallowing habit of them to prevent insects (Hussain et al., 2006; Tasawar et al., 2008).

The results of age-wise prevalence in this study were in agreement with Islam et al. (2009), Mamun et al. (2010), Desoky (2014), who found that prevalence of ectoparasitic infestation was higher in older group of buffaloes. Sarkar et al. (2010), postulates that the robust innate immunity and age resistance of young cattle contribute to their reduced susceptibility to tick infection, hence reducing the ectoparasitic burden. In case of gender, females were more likely to be infected than males, due to the close relation of the female with their calves during milking and the managemental systems where most of the sampled buffalo were confined within the farm. Additionally, production stressors like pregnancy and breastfeeding increase the vulnerability of female animals to infection (Mamun et al., 2010).

Seasons play a critical role in the transmission of ectoparasites due to the influence of environmental conditions on the survival of these ectoparasites. Sanjay et al. (2007), reported the seasonal prevalence of ectoparasites were significantly higher in winter, which is in accordance with our study. This behavior in the summer could be caused by the late-winter temperature increase, which would gradually raise the burden and the percentage of infestation in May and June (Roy et al., 2001). This discrepancy between the current and previous results can be explained by the differences in topography, soil type, humidity, and above all the world's alarming climate (Rony et al., 2010). Free-range buffalo are exposed to a variety of environments such as, open pasture land, and water bodies where ectoparasites like ticks, lice, and flies thrive. These areas often harbor higher densities of ectoparasites, increasing the likelihood of infestations (Rabbi et al., 2006 Rony et al., 2010). Because of an evolutionary strategy to lessen competition with other species and diminish host defensive systems, the ectoparasites have different attachment sites on the buffalo's body (De Castro J, 1997; Abd El-Aleem et al., 2014). Several variables, including the length of mouthpart, and morphology, affect the preferred attachment sites. Additionally, ectoparasites choose a location with a plentiful blood supply and little host resistance, allowing them to pierce the skin readily (Dantas-Torres F, 2010; Patel et al., 2013).

The epidemiological study of ectoparasites in buffaloes from selected parts of Bangladesh shows relatively low prevalence (17.41%). However, the presence of important ectoparasite species including *H. bispinosa*, *R. microplus*, and *L. vituli* is alarming due to their capability to transmit various diseases. Moreover, higher infestation in winter indicates the need for season-specific ectoparasite control in the study population. The findings also highlight the urgent need for routine surveillance and the implementation of effective ectoparasite control strategies to minimize their impact on animal productivity and reduce associated zoonotic risks.

Acknowledgement

We would like to thank Department of Microbiology and Parasitology, Sher-e-Bangla Agricultural University, Dhaka for providing laboratory space to conduct the study.

Ethical Declaration

The Department of Livestock Services (DLS) verbally granted authorization for sampling, and all necessary processes were completed under the Animal Welfare Act of 2019.

Conflict of Interest

The authors declare that they have no competing interests.

Authorship contributions

Concept: S.A., Design: S.A., M.K., Data Collection or Processing: M.H., S.U., Analysis or Interpretation: M.I., Literature Search: S.A., M.K., Writing: S.A.

Financial Support

All the author sincerely acknowledges the financial grant offered by the Ministry of Science and Technology (MoST), Bangladesh in carrying out the research project.

REFERENCES

Aatish HU, Sindhu Z, Iqbal Z, Jabbar A, Tasawar Z. 2007. Prevalence of sheep mange in District Dera Ghazi Khan (Pakistan) and associated hematological/biochemical disturbances. International journal of agriculture and biology, 9(6): 917-920.

Abd El-Aleem SS, Desoky A, Maher KH, Abdel-Gwad A, Nafady N. 2014. Distributing the population density of ectoparasites on the animal body surface in animal production farms. Research Journal of agriculture and environmental management, 3(6): 270-273.

Apanaskevich DA, Mumcuoglu KY, Steinman A. 2018. Species distribution and seasonal dynamics of equine tick infestation in two Mediterranean climate niches in Israel. Parasites & vectors, 11(1): 1-10.

Arora DR, Arora B. 2012. Medical Parasitology, fourth ed. CBS Publishers and Distributors.

Batista HR, Sarturi C, Stelmachtchuk FN, Oliveira DR, Morini AC, Gennari SM, Marcili A, Bastos FAN, Barata LES, Minervino AHH. 2018. Prevalence and risk factors associated with ectoparasite infestation of buffaloes in an Amazonian ecosystem. Parasites & vectors, 11(1): 335.

Borghese A. 2005. Buffalo production and research. FAO Regional Office for Europe. In: Borghese A, editor. Technical Series 67. Italy: Food and Agriculture Organization Rome.

Dantas-Torres F. 2010. Biology and ecology of the brown dog tick, *Rhipicephalus sanguineus*. Parasites & Vectors, 3(1): 26-35.

De Castro JJ. 1997. Sustainable tick- and tick-borne disease control in livestock improvement in developing countries. Veterinary parasitology, 71(2-3): 77-97.

Desoky AS. 2014. The relationship between sex and age of buffalo's infestation with ectoparasites in Sohag Governorate, Egypt. International journal of plant and animal sciences, 4(2): 131-132.

Green ED, Urner ML, Ebei PJS. 2001. The functional micromorphology of the Goat biting louse (*Bovicola caprae*). Proceedings of the microscopy society of Southern Africa, 31: 62.

Hamid MA, Zaman MA, Rahman A, Hossain K. 2016. Buffalo genetic resources and their conservation in Bangladesh. Research journal of veterinary sciences, 10(1): 1-13.

Hornok S, Kontschán J, Keve G, Takács N, Nguyen DV, Ho KNP, Görföl T, Wang Y, Farkas R, Dao TTH. 2025. First report of *Haemaphysalis bispinosa*, molecular-geographic relationships of *Ixodes granulatus* and a new *Dermacentor* species from Vietnam. Parasites & vectors, 18: 21-36.

Hussain MA, Khan MN, Iqbal Z, Sajid MS, Arshad M. 2006. Bovine pediculosis: prevalence and chemotherapeutic control in Pakistan. livestock research for rural development, 18(10): 1-14.

Iqbal A, Sajid MS, Khan MN, Muhammad G. 2014. Epizootiology of ectoparasitic fauna infesting selected domestic cattle population of Punjab, Pakistan. International journal of agriculture and biology, 16(2): 443-446.

Islam MK, Alim MA, Tsuji N, Mondal MMH. 2006. An investigation into the distribution, host-preference and population density of Ixodid ticks affecting domestic animals in Bangladesh. Tropical animal health and production, 38(6): 485-490.

Jongejan F, Uilenberg G. 2004. The global importance of ticks. Parasitology, 129: S3–14.

Kakar MN, Kakarsulemankhel JK. 2008. Prevalence of endo (trematodes) and ecto-parasites in cows and buffaloes of Quetta, Pakistan. Pakistan veterinary journal, 28(1): 34-36.

Kumsa B, Socolovschi C, Parola P, Rolain J-M, Raoult D. 2012. Molecular detection of acinetobacter species in lice and keds of domestic animals in Oromia Regional State, Ethiopia. PLoS ONE, 7(12): e52377.

Makwarela TG, Nyangiwe N, Masebe TM, Djikeng A, Nesengani LT, Smith RM, Mapholi NO. 2024. Morphological and molecular characterization of tick species infesting cattle in South Africa. Veterinary sciences, 11(12): 638-660.

Mamun MAA, Begum N, Shahadat HM, Mondal MMH. 2010. Ectoparasites of buffaloes (*Bubalus bubalis*) in Kurigram district of Bangladesh. Journal of Bangladesh Agricultural University, 8(1): 61-66.

Manan A, Khan Z, Ahmad Z, Abdullah B. 2007. Prevalence and identification of Ixodid tick genera in Frontier region Peshawar. International journal of agriculture and biology, 2: 21-22.

Minervino AHH, Zava M, Vecchio D, Borghese A. 2020. *Bubalus bubalis*: a short story. Frontiers in veterinary science, 7: 570413.

Mullen GR, Durden LA. 2018. Medical and Veterinary Entomology, third ed. Academic Press, London, United Kingdom.

Patel G, Shanker D, Jaiswal AK, Sudan D, Verma SK. 2013. Prevalence and seasonal variation in ixodid ticks on cattle of Mathura district, Uttar Pradesh. Journal of parasitic diseases, 37(2): 173-176.

Rony SA, Mondal MMH, Begum N, Islam MA, Affroze S. 2010. Epidemiology of ectoparasitic infestations in cattle at Bhawal Forest area, Gazipur. Bangladesh Journal of Veterinary Medicine, 8(1): 27-33.

Rony SA, Mondal MMH, Begum N, Islam MA, Affroze S. 2010. Epidemiology of ectoparasitic infestations in cattle at Bhawal Forest area, Gazipur. Bangladesh. Journal of Veterinary Medicine, 8(1): 27-33.

Ruprah NS. 1985. Text book of Clinical Protozoology, Oxanian Press Pvt. Ltd. New Delhi.

Sahito HA, Kousar T, Mughal MA, Mangrio WM, Shah ZH, Ghumro BD, Jatoi FA. 2017. Prevalence of cattle lice; *Haematopinus tuberculastus* and Ticks; *Haemaphysalis bispinosa* on cattle at region Sukkur, Sindh - Pakistan. International journal of research studies in biosciences, 5(12): 1-5.

Sajid MS, Iqbal Z, Khan MN, Muhammad G. 2008. Point prevalence of hard ticks (Ixodids) infesting domestic ruminants of Lower Punjab, Pakistan. International journal of agriculture and biology, 10(3): 349-351.

Sarkar M, Rahman SA, Sarker BK, Anisuzzaman, Begum N, Mondal MMH. 2010. Epidemiology and pathology of ectoparasitic infestations in Black Bengal Goats in Gaibandha and Mymensingh districts of Bangladesh. Bangladesh journal of veterinary medicine, 8(1): 41-50.

Sayyad B, Mughal SH, Iqbal MN, Ashraf A, Muhammad A. 2016. Prevalence of ectoparasites of ruminants in Muzaffarabad District, Azad Jammu and Kashmir. PSM veterinary research, 1(1): 22-25.

Shamim A, Mushtaq A, Hassan MU. 2015. No record of lice (Pthiraptera) distribution and abundance in traditionally managed buffalo and cattle in Rawalakot Azad Kashmir Pakistan. Journal of entomology and zoology studies, 3(3): 416-418.

Soulsby EJL. 1982. Helminths, Arthropods and Protozoa of Domesticated Animals, seventh ed. Bailliere Tindall, London.

Sultana N, Awan MS, Shamim A, Iqbal A, Ali U, Minhas RA, Mahmood M, Bangash N. 2015. Prevalence of ticks infesting selected domestic livestock population of Azad Jammu and Kashmir. Scholar's advances in animal and veterinary research, 2(2): 98-106.

Tasawar Z, Bano I, Hayat CS, Lashari MH. 2008. Prevalence of lice on buffaloes at private cattle farm. Pakistan veterinary journal, 28(3): 147-149.

Taylor MA, Coop RL, Wall RL, Veterinary Parasitology. 4 th ed. USA: Willey Black well; 2016.

Taylor MA, Coop RL, Wall RL. 2016. Veterinary Parasitology, fourth ed. Blackwell publishing, Oxford.

Wall R, Shearer D. 2008. Veterinary Ectoparasites: Biology, Pathology and Control, second ed. Blackwell Science Ltd.