Research Article

Updated Investigation on Blood-Borne Parasitic Illnesses and Tick Infestation in Daulatpur, Khulna, Bangladesh: Incidence and Determinants

Md. Asaduzzaman Lovelu[1], Md. Amir Hossain[2*], Md. Uzzal Hossain[1], Tanzila Zafrin Tanvi[1], Mahfuza Ferdous[3], Nazmin Sultana Runa[4], Assrafi Siddika[3], Md. Sahidul Islam[2]

[1]Department of Animal Science, Khulna Agricultural University, Bangladesh; [2]Department of Poultry Science, Khulna Agricultural University, Bangladesh; [3]Department of Animal Nutrition, Khulna Agricultural University, Bangladesh;4Department of Physiology, Khulna Agricultural University, Bangladesh.

Abstract | Ticks, as disease carriers, seriously impair the livestock sector's financial standing, particularly in Bangladesh. The study's goal was to investigate the risk factors and prevalence of tick infestations that cause economic harm to livestock as well as related diseases. A total 557 calves were analyzed between January and May of 2023, with age, sex, housing, and health categories. By hand-picking ticks, blood parasites were examined under a stereomicroscope and stained with Giemsa's stain. Among the investigated cattle, 37.88% had tick infestations: 14% had *Rhipicephalus* (*Boophilus*) *microplus*, 28.01% had *Haemaphysalis bispinosa,* and 4.13% had mixed infections. Adult cattle older than 2.5 years old (41.05%) had the highest prevalence of tick infestations, while calves younger than a year (33.57%) had the lowest prevalence. Crossbred cattle were more susceptible to infection than native cattle (41.75% vs. 28.99% for females vs. 28.99% for males). Higher infection rates were seen in cattle with poor health (58.57%) and those with muddy floors (46.89%). Additionally, semi-intensive systems' prevalence was higher than intensive systems (41.10% vs. 14.70%). Tick infection rates were also higher in the summer (47.28%) and lower in the winter (12.90%). Giemsa-stained peripheral blood smears from 245 calves were examined under a microscope, and it was discovered that there was a 3.27% prevalence of subclinical blood parasite illnesses, with 2.49% having babesiosis and 0.82% having anaplasmosis. Tick infestations are affected by several factors such as age, sex, breed, health, flooring, rearing practices, and seasons, indicating the need for better management measures.

Keywords | Cattle, Prevalence, Risk factor, Tick, Babesiosis, Anaplasmosis

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***Correspondence** | Md Amir Hossain, Department of Poultry Science, Khulna Agricultural University, Bangladesh; **Email:** dr. amir.kau@gmail.com
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INTRODUCTION

Parasitic diseases are a global issue that are a serious obstacle to cattle health and production performance. Ticks are a potentially dangerous external parasite that feeds on the blood of mammals, birds, and reptiles all over the world. The prevalence of ticks and tickborne blood parasitic diseases are most common in Bangladesh and cause economic losses (Ananda et al., 2009). They are voracious blood suckers and cause heavy financial losses to the livestock industry (Branscheid and Schroer, 1997). In some ixodid ticks, estimated blood loss ranges from 0.7 mL to 8.9 mL per female (Balashov, 1972).

Moreover, the wounds may lead to secondary bacterial infections and invite flies to lay eggs and myiasis development. The conditions diminish the quality of skin/hide by up to 20-30% and eventually depreciate the value of livestock. Babesiosis, another reason for economic loses in livestock farming caused by *Babesia bovis* and *B. bigemina*

and transmitted by the tick *Boophilus sp*., is the most common tickborne blood protozoan disease (Jongejan et al., 1986). Babesiosis is clinically manifested by high temperature, hemoglobinuria (coffee-colored urine), lethargy, and temperature fall andy death (Soulsby, 1982). Anaplasmosis is a tick-borne haemorickettsial disease of cattle caused by *Anaplasma marginale* and *Anaplasma centrale*. It is characterized clinically by fever, weakness, severe anemia, jaundice, brownish urine, pale mucous membranes, weight loss, decreased milk production, abortion, and mortality without haemoglobinemia and hemoglobinuria during the acute phase of infection (Minjauw and McLeod, 2003). The prevention and spread of diseases carried by ticks remain a difficulty for Bangladesh's cattle industry due to ticks' economic and veterinary relevance. Tick born diseases is a top concern for many tropical and subtropical nations. As a result the study aims were to ascertain the prevalence of tick infestation, tick born blood parasitic diseases (babesiosis and anaplasmosis) and risk factors associated with tick infestation in cattle in the study area.

MATERIALS AND METHODS

This study protocol was reviewed and approved by the Department of Parasitology, Faculty of Veterinary, Animal and Biomedical Sciences, Khulna Agricultural University, Khulna-9202, Bangladesh (2023EC-01). Ticks and blood samples were collected from randomly selected cattle in the study area for the experiment. Ticks and blood samples were examined in a Parasitology Laboratory.

Selection And Examination Of Cattle

A total of 557 cattle were selected at random from various places. The selected cattle were examined for clinical signs of tick infection, if any, using close observation, palpation, and hair parting against their natural direction. Before examination, age, sex, breed, floor type, health status, season and rearing system of animals, and other relevant data were collected by interrogating the farmers and recorded carefully (Samad, 2008).

Grouping Of Cattle

Cattle were grouped into different age groups, calves, adults, and different health status groups, normal health conditioned and poor health conditioned cattle,different rearing groups, semi-intensive and intensive systems. To study the influence of seasons of the year, the year was divided into three seasons: summer, rainy, and winter.

Tick Sample Collection And Preservation

Ticks were physically removed from the sick cattle's body in various locations. After Collection, ticks were put in separately labeled glass vials containing 70% ethanol and preserved in the laboratory.

Identification Of Samples

The ticks were identified based on their morphology in a Laboratory of Parasitology. Ticks were tentatively identified using a stereomicroscope. Final identifications were made using a compound microscope and permanent slides prepared in accordance with the procedure. The specimens were placed at room temperature in a petridish with 10% KOH until all colors on the body and legs vanished. KOH was eliminated by repeatedly changing the tap water and immersing the workers for 12 hours every shift. The specimens were then dehydrated by gradually passing them through 30%, 40%, 50%, 60%, 70%, 80%, and 90% ethyl alcohol for 15 minutes in each case. The specimens were then immersed in 100% alcohol for 1 hour. (Cable, 1967). The specimens were removed and cleared in a petridish with aniline oil until they sank to the bottom and were completely transparent. The aniline oil was drained off, and the specimens were mounted on clean glass slides. The mounting agent was then allowed to solidify. Excess mounting agent was removed, and the slides were appropriately labeled. Finally, morphology-based identification was conducted under the microscope (Wall and Shearer, 1997; Soulsby, 1982).

Study On Blood Parasites

Collection Of Blood Samples

The study was carried out on 245 cattle consisting of 128 indigenous and 117 crossbred cattle. Blood samples were taken by puncturing each cattle's ear vein using a sterile disposable needle. Two or three thin blood smears were produced, then methanol fixed, stained with Giemsa's stain, then viewed under a microscope (100X) with immersion oil to detect and identify. The cattle were divided into age groups to determine the age and breed susceptibility to blood parasites.

Blood Film Preparation

A single small drop of blood was placed toward the end of a perfectly clean and dry glass slide. A dry spreader slide with a regular edge was placed at a 45° angle on the glass slide and brought into contact with the blood sample. When the blood sample spread over the spreader slide's contact edge, it was pushed forward gently and smoothly. For each animal, two or three thin blood films were produced, dried in the air, then fixed in 100% methyle alcohol for three minutes. The slides were stained with freshly filtered and diluted Giemsa's stain for 40-45 minutes, then washed with distilled water for a few seconds to remove excess of stain. The slides were allowed to dry and examined under microscope using oil immersion.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) for the Z test. In

addition to the Z test, data were evaluated using a paired sample t-test to compare tick prevalence in relation to age, gender, breed, nutritional status, and house floor. The odds ratio was calculated according to the formula given by Schlesselman (1982).

RESULTS

Prevalence Of Tick Infestation

Out of the 557 cattle evaluated, 211 (37.88%) were infested with one or more tick species. The cattle were found to be infested with *R.* (Boophilus) *microplus*, *H. bispinosa*, or both species (mixed infection), as determined by morphological traits. The infestation rate with *R. (Boophilus) microplus, H. bispinosa* and with both the species (mixed infestation) were recorded 14%, 28.01% and 4.13% in study areas (Table 1).

Tick Burden And Species Identification

During the study period, tick infestation was detected the highest in adult cattle of > 2.5 years of age (41.05%), the lowest in calves of ≤ 1 year of age (33.57%) and in young cattle the infestation rate was (37.23%). Young cattle were shown to be 1.17 times more susceptible to tick infestation than calves, whereas adults were found to be 1.38 and 1.17 times more sensitive to tick infestation than calves and young cattle, respectively.. The prevalence of *H. bispinosa* (26.43%) infestation was higher than that of *R.* (*Boophilus*) *microplus (*10.0%) in calves. In young cattle, *H. bispinosa* (26.03%) infestation rate was higher than *R.* (*Boophilus*) *microplus* (14.79%). Like in calves and young cattle, in adults, the prevalence of *H. bispinosa* (30.57%) was higher *R. (Boophilus) microplus* (15.84%). Mixed infestation was recorded 2.88%, 4.08% and 4.98% in calves, young cattle and adults (Table 2).

Influence Of Sex Of The Cattle To Their Susceptibility To Tick Infestation

Female cattle were shown to be more susceptible to tick infestation than male cattle, with a considerably (p = 0.004) greater prevalence rate of tick infestation in females (41.75%) than males (28.99%). (Table 3). The odds ratio calculation indicated that female cattle were 1.75 times more susceptible to tick infestations than male cattle. In cattle of both sexes *H. bispinosa* was the more prevalent tick among the two species. In females, the overall prevalences of *H. bispinosa* infestation (30.93%) was significantly (p = 0.004) higher than that in males (21.30%). *R.(Boophilus) microplus* infestation was found also higher in the females (15.46%) than in the males (10.65%). Considering the positive cases, the infestation rate of *H. bispinosa, R.(Boophilus) microplus* and mixed infestation were higher in the females (74.07%, 37.04% and 11.11%, respectively) than those in the males (73.45%, 36.73% and 10.20%, respectively).

The Susceptibility Of Cattle To Tick Infestation Varies According To Breed

Cattle susceptibility was observed to differ considerably (p = 0.033) between breeds. Crossbred cattle were more prone to tick infestation than native cattle. Tick infestation was found in 44.23% of crossbred cattle and 35.42% of indigenous cattle. (Table 4). Tick infections were 1.45 times more likely in crossbred cattle than in indigenous cattle. In the positive cases, the infestation rate in crossbred by *H. bispinosa* (64.70%), *R.(Boophilus) microplus* (32.77%) and mixed infestation (5.88%) were found lower than the infestation rate in indigenous cattle by *H. bispinosa* (77.45%), *R.(Boophilus) microplus* (38.23%) and by mixed infestation (15.69%).

Prevalence Of Tick Infestation In Relation To The Health Status Of Cattle

The overall prevalence rate of tick infestation was significantly (p = 0.0001) greater in cattle in poor health (58.57%) than in cattle in normal health (34.91%). The odds ratio indicated that cows in poor health were 2.64 times more susceptible to tick infection than cattle in normal health. In poor body-conditioned cattle, *H. bispinosa* infestation (47.14%) was the highest followed by *R.(Boophilus) microplus* (20%) and mixed infestation (8.57%). Similar trends of prevalence of ticks were also recorded in normal health-conditioned cattle where *H. bispinosa, B. microplus,* and mixed infestation were 25.26%, 13.14% and 3.49%, respectively (Table 5).

Prevalence Of Tick Infestation In Relation To The Cow Shed Floor

The overall frequency was significantly (P <0.05) greater in cattle housed on muddy floors (46.89%) than in cattle kept in concrete-floored houses (31.33%) (Table 6). Tick infestation in cattle kept on muddy floor were 38.17%, 16.60%, 7.88% by *H. bispinosa*, *R.(Boophilus) microplus* and mixed infestation, respectively which were higher than in cattle kept on concrete floor where *H. bispinosa, R.(Boophilus) microplus* and mixed infestation were recorded 20.60%, 12.02% and 1.26%, respectively. According to the odds ratio estimate, cattle on muddy floors were 1.93 times more susceptible to tick infestation than those on clean floors.

Influence Of Rearing System On The Prevalence Of Tick Infestation In Cattle

The results of tick infestations in cattle of different types of rearing systems are Significantly (p = 0.00003) higher prevalence of tick infestation was recorded in cattle reared in semi-intensive system (41.10%) than in cattle raised in the intensive system (14.70%). The infestation in cattle reared in semi-intensive system was 30.26%, 15.54% by *H. bispinosa* and *R.(Boophilus) microplus*, respectively, higher than in cattle raised under intensive system. In cattle of in

Table 1: Overall prevalence of tick infestation in cattle at the study area

No. of cattle examined	Total no. of cattle infested (%)	Name of ticks	No. of cattle infested	Prevalence of infestation (%)
557	211 (37.88)	*R. (Boophilus) microplus*	78	14.00
		H. bispinosa	156	28.01
		Mixed infestation	23	4.13

Table 2: Prevalence of tick infestation in relation to the age of cattle

Age of cattle	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Calf (≤ 1 year) n = 140	*R. (Boophilus) microplus*	14	10.00	29.79	Young vs Calves = 1.17
	H. bispinosa	37	26.43	78.72	
	Mixed infestation	4	2.88	8.51	
	Subtotal	47	**33.57**		
Young (>1 - 2.5 year) n = 188	*R. (Boophilus) microplus*	29	14.79	37.18	Adults vs Young = 1.17
	H. bispinosa	49	26.03	70.00	
	Mixed infestation	8	4.08	10.26	
	Subtotal	70	37.23		
Adult (>2.5 year) n = 229	*R. (Boophilus) microplus*	35	15.84	40.70	Adults vs Calves =1.38
	H. bispinosa	70	30.57	74.47	
	Mixed infestation	11	4.98	12.79	
	Subtotal	94	41.05		
p- value =0.34*					

n= number of animals examined.
*Statistically insignificant (p>0.05).

Table 3: Influence of sex of the cattle to their susceptibility to tick infestation

Sex of the cattle	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Males n=169	*R. (Boophilus) microplus*	18	10.65	36.73	Females vs Males = 1.75
	H. bispinosa	36	21.30	73.45	
	Mixed infestation	5	2.96	10.20	
	Subtotal	49	**28.99**		
Females n=388	*R. (Boophilus) microplus*	60	15.46	37.04	
	H. bispinosa	120	30.93	74.07	
	Mixed infestation	18	4.64	11.11	
	Subtotal	162	41.75		
p- value = 0.004*					

n= number of animals examined.
*Statistically significant (p<0.05).

tensive system, 11.76%, *H. bispinosa* and 2.94% *R.(Boophilus) microplus* were recorded (Table 7).

Seasonal Effects On The Distribution Of Tick Infestation In Cattle

The highest prevalence of infestation was encountered in summer (47.28%) declined gradually through the rainy season (33.77%), and reached to its lowest level in winter (12.90%). According to the odds ratio, cattle were 2.78 times more prone to tick infection during the wet season

Table 4: Variation in the susceptibility of cattle to tick infestation in relation to the breeds

Breed of cattle	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Indigenous n=288	*R. (Boophilus) microplus*	39	13.54	38.23	Cross-bred vs Indigenous =1.45
	H. bispinosa	79	27.43	77.45	
	Mixed infestation	16	5.55	15.69	
	Subtotal	102	35.42		
Cross-Bred n=269	*R. (Boophilus) microplus*	39	14.49	32.77	
	H. bispinosa	77	28.62	64.70	
	Mixed infestation	7	2.60	5.88	
	Subtotal	119	44.23		
p- value = 0.033*					

n= number of animals examined.
*Statistically significant (p<0.05).

Table 5: Prevalence of tick infestation in relation to the health status of cattle

Health status of cattle	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Normal n=487	*R. (Boophilus) microplus*	64	13.14	37.65	Poor Vs Normal = 2.64
	H. bispinosa	123	25.26	72.35	
	Mixed infestation	17	3.49	10	
	Subtotal	170	34.91		
Poor n=70	*R. (Boophilus) microplus*	14	20	34.15	
	H. bispinosa	33	47.14	80.49	
	Mixed infestation	6	8.57	14.63	
	Subtotal	41	58.57		
p- value =0.0001*					

n= number of animals examined.
*Statistically significant (p<0.05).

Table 6: Prevalence of tick infestation in relation to the floor of the cattle shed

Floor of cattle shed	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Concrete n=316	*R. (Boophilus) microplus*	38	12.02	38.38	Muddy vs concrete floor =1.93
	H. bispinosa	65	20.60	65.65	
	Mixed infestation	4	1.26	4.04	
	Subtotal	99	31.33		
Muddy n=241	*R. (Boophilus) microplus*	40	16.60	35.40	
	H. bispinosa	92	38.17	41.42	
	Mixed infestation	19	7.88	16.81	
	Subtotal	113	46.89		
p- value =0.0002*					

n= number of animals examined.
*Statistically significant (p<0.05).

Table 7: Influence of rearing system on the prevalence of tick infestation in cattle

Rearing system of cattle	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			overall	Among positive case	
Intensive n=68	*R. (Boophilus) microplus*	2	2.94	20	
	H. bispinosa	8	11.76	80	Semi-intensive vs Intensive = 4.05
	Mixed infestation	0	0	0	
	Subtotal	10	14.70		
Semi-intensive n=489	*R. (Boophilus) microplus*	76	15.54	37.81	
	H. bispinosa	148	30.26	73.63	
	Mixed infestation	23	4.70	11.44	
	Subtotal	201	41.10		
p- value = 0.00003*					

n= number of animals examined.
*Statistically significant (p<0.05).

Table 8: Influence of seasons on the distribution of tick infestation in cattle

Season	Name of ticks recovered	No. of cattle affected	Prevalence (%)		Odds ratio
			Overall	Among positive case	
Winter n = 93	*R. (Boophilus) microplus*	4	4.30	33.33	
	H. bispinosa	10	10.75	83.33	Rainy vs Winter = 2.78
	Mixed infestation	2	2.15	16.67	
	Subtotal	12	12.90		
Rainy n = 151	*R. (Boophilus) microplus*	23	15.23	52.27	
	H. bispinosa	36	23.84	81.82	Summer vs Rainy = 2.18
	Mixed infestation	8	5.30	18.18	
	Subtotal	44	33.77		
Summer n=313	*R. (Boophilus) microplus*	51	16.29	34.46	
	H. bispinosa	110	35.14	74.32	Summer vs Winter = 6.00
	Mixed infestation	13	4.15	8.73	
	Subtotal	148	47.28		
p- value =0.00001*					

n= number of animals examined.
*Statistically significant (p<0.05).

Table 9: Prevalence of subclinical blood parasitic diseases in cattle

Age of the animals	No. of animal examined (N= 245)	Babesiosis		Anaplasmosis		Theileriosis	
		No. of infected animals	Percentage of infection (%)	No. of infected animals	Percentage of infection (%)	No. of infect-ed animals	Percentage of infection (%)
Calf < 1 year	23	-	-	-	-	-	-
Young (>1 - ≤2 year)	47	-	-	-	-	-	-
Adult (>2 year)	175	6	3.45	2	1.14		
Total	245	6	2.49	2	0.82		
p- value= 0.005							

Table 10: Susceptibility of different breeds of cattle for parasitic diseases

Breed of the animals	No. of animal examined (N= 245)	Babesiosis		Anaplasmosis		Theileriosis	
		No. of infected animals	Percentage of infection (%)	No. of infected animals	Percentage of infection (%)	No. of infected animals	Percentage of infection (%)
Indigenous	128	2	1.56	-	-	-	-
Cross-bred	117	4	3.42	2	1.71	-	-
Total	245	8(3.27)					
p- value= 0.117							

than during the winter. In contrast, cattle were 2.18 and 6.00 times more prone to tick infestation in the summer than in the rainy and winter seasons, respectively (Table 8).

Prevalence Of Blood Parasitic Diseases In Cattle

This study looked at the prevalence of tick-borne blood parasite infections in cattle.. Microscopic study of blood film from apparently healthy cattle revealed one haemo protozoan disease, babesiosis caused by *Babesia* spp. and the anaplasmosis produced by Anaplasma centrale and Anaplasma marginale, and the hemolytic ricketsial illness. Of the 245 cattle examined, 6(2.49%) were infected with Babesia spp. and 2 (0.82%) were infected with *Anaplasma* spp. Interestingly blood parasitic infection could be detected only in cattle of 2 years of age, where babesiosis and anaplasmosis were in 6(3.45%) and 2(1.14%) cattle, respectively (Table 9). However, no case of theileriosis could be detected during this study.

Susceptibility Of Different Cattle Breeds To Blood Parasitic Diseases

Susceptibility of tickborne blood parasitic diseases were investigated in indigenous and crossbred cattle. The findings revealed that crossbred cattle were more vulnerable than indigenous livestock. In crossbred cattle, both babesiosis (4/3.42%)) and anaplasmosis (2/1.71%) were found. However, only babesiosis (2/1.56%) in indigenous cattle but no anaplasmosis could be detected (Table 10).

DISCUSSION

In this study, the overall prevalence of tick infestation in cattle was 37.88%. This finding is consistent with Haque's reports (2014) at Barind Tract (35.7%), Akter (2013) at Shahjadpur (36.80%), Roy et al. (2001) at Madhupur (36.31%), Kabir et al. (2009) at Chittagong (36.3%) in Bangladesh and Ramzan et al. (2008) in Pakistan (36%). However, the present results are lower than the previous findings of Habib (2013) at Mymensingh Sadar and Shahjadpur Milk Vita Area (42%).

Baroi (2009) identified three species of ticks, namely, *B. microplus* (63.01%), *H. bispinosa* (38.35%), and *R. sanguineus* (17.80%) infesting cattle and goats in Charvadrason, Faridpur. Islam et al. (2009) recorded 65.4% ectoparasitic infestation in cattle in Sirajganj district that included *B. microplus* (35.5%), *R. sanguineus (*10.6%) and *H. bispinosa* (7.8%) infestation. Habib (2013) identified two tick species namely *B. microplus* (46.8%) and *H. bispinosa* (28.4%) in Mymensingh district.

Tick infestation was more common in adults (43.3%) and young (44%) than in calves (35.6%), according to Habib (2013) at Mymensingh Sadar and Shahjadpur. The present findings also agree with the previous reports of Baroi (2009) and Rony et al. (2010). Adult cattle had the highest incidence (84%), followed by young cattle (67.7%), and calves (47.1%), according to Baroi (2009) in Mymensingh district. Also, Joseph et al. (2014) reported a much higher tick infestation rate in adults (96.66%) than in calves (48.94%) in Nigeria.

According to this study, females had a significantly ($p<0.05$) greater prevalence of tick infestation (41.75%) than males (28.99%). This finding is substantiated by the previous reports of Akter (2013) and Habib (2013) at Mymensingh Sadar and Shahjadpur, Sen et al. (2012) at Madhukhali upazila of Faridpur, Rony et al. (2010) at Bogra, Kabir et al. (2009) at Chittagong in cattle and Mamun et al. (2010) at Kurigram in buffaloes in Bangladesh.

Compared to cattle in normal health, those in poor body condition were significantly ($p<0.01$) more susceptible to tick infestations. The findings of this study are confirmatory to the reports of Bilkis (2009) at Kahaloo, Bogra and Baroi (2009) at Mymensingh, Habib (2013) at Shahjadpur and Mymensingh and Haque (2014) at Barind Tract. Teglas et al. (2005) reports in Guatemala also support these results.

The prevalence of ticks in cattle was found to be strongly affected by the type of floor in cattle sheds. The prevalence of higher infestation in cattle reared on muddy floor than

in cattle kept on the concrete floors is in agreement with the reports of Akter (2013) in Mymensingh and Sirajgonj. The observation of the maximum incidence of infection in the summer and the lowest level in the winter is consistent with earlier findings. of Rony et al. (2010), Islam et al. (2006), Kamal et al. (1996) and Mondal et al. (1995) in Bangladesh. Joseph et al. (2014) recorded 32.16% infestation in the dry season and 11.72% in the wet season in Nigeria.

The incidence of subclinical babesiosis found in this study is consistent with the findings of Samad et al. (1989), who found 3.28% subclinical prevalence of *B. bigemina* infection in cattle in the designated Milk Vita project areas of Bangladesh, as well as the findings of other studies. of Akter (2013). Habib (2013) and on microscopic inspection of a peripheral blood smear, Shahidullah (1983) found a comparatively lower frequency of babersiosis (1.3%) and (2.29%) in cattler. However, Banerjee et al. (1983) found a greater prevalence of *B. bigemina* in cattle in Bangladesh (14.53%), while Aulakh (2003) found a higher prevalence in India (5.94%).

The current study's subclinical anaplasmosis infection confirms the findings of Akter (2013) and Habib (2013). The findings contrast from those of Samad et al. (1989), who found 5.93% subclinical Anaplasma infection in cattle in Bangladesh. Also, the present finding is much lower than the previous report of Talukder et al. (2001), who recorded 33% of cattle in the Baghabari Milk Shed area of Bangladesh were infected with *Amaplasma* spp. This study discovered a cattle age barrier in the case of both Babesia and Anaplasma infection. Anaplasmosis in relation to bovine age is supported by reports from Mohanta et al. (2011), and Ananda et al. (2009), who reported that animals above 2 years of age were substantially impacted by blood parasite infections. Surprisingly, no calves under the age of two were infected with *Babesia* spp. or *Anaplasma* spp. The current data and prior findings support the "inverse age resistance" phenomena in animal blood protozoan infections. (Soulsby, 1982; Urquhart et al., 1996, Annetta et al., 2005)

The current study found a decreased prevalence of blood protozoan infection in indigenous cattle compared to crossbred cattle, which is consistent with previous findings of Radostits et al. (2000). The genetic makeup of indigenous cattle may be responsible for the lower occurrence of blood parasite infections. (Siddiki et al., 2010).

CONCLUSIONS

The present study suggests that tick infestation by *R.* (*Boophilus*) *microplus* and *H. bispinosa* are highly endemic in indigenous and croos-bred cattle at Daulatpur Thana of Khulna District. *H. bispinosa* is the predominant species and cattle may become infestated by single tick species or concomitantly with both species. The most important risk factors regulating the prevalence of tick infestation were health status, cattle rearing system, and seasons of the year. The tick infestation was also influenced by age, gender, cattle breed, and home floor. The deadly blood parasitic diseases such as babesiosis and anaplasmosis are prevalent in subclinical form, which may be fatal to the animals, causing great economic loss. Further advanced studies are required to know the detail biology of the parasites, calculate the financial losses caused by them and create an effective control program against ticks and tick borne blood parasitic diseases.

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CONFLICT OF INTEREST

The authors have declared that there is no conflict of interests regarding the publication of this article.

NOVELTY STATEMENT

Ticks appear in Bangladesh's pastoral rhythms as covert creators of economic strife. Their little legs weave through the delicate balance of livelihoods, as well as through the hides of animals. We dissect the choreography of this epidemiological ballet, with age, sex, breed, and seasons spinning in perfect harmony. With the curtain rising, our spotlight reveals the unseen participants: Haemaphysalis bispinosa, Rhipicephalus (Boophilus) microplus, and their complex interactions. Come along on this voyage into the parasite world, as ticks dance with floors, health, and management strategies—a harmonious dance of survival and avoidance.

AUTHORS CONTRIBUTION

Md. Asaduzzaman Lovelu: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Md Amir Hossain:** Investigation, Supervision, Validation, Visualization. **Md. Uzzal Hossain:** Writing – original draft, Writing – review & editing. **Tanzila Zafrin Tanvi:** Visualization, Writing

– original draft, Writing – review & editing. **Mahfuza Ferdous:** Conceptualization, Investigation, Methodology. **Nazmin Sultana Runa:** Investigation, Resources. **Assrafi Siddika:** Investigation, Methodology, Resources. **Md. Sahidul Islam:** Methodology, Validation, Visualization, Writing – review & editing.

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