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RESEARCH

Mapping the Ectoparasitic Landscape in Non-Descriptive Village Chickens of Central Bangladesh: Prevalence, Intensity, and Associated Risk Factors

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ABSTRACT

Purpose: *Ectoparasitic infestations pose a major threat to non-descriptive village chickens (NDVCs) and could result in economic losses. However, systematic data regarding the ectoparasitic burden on NDVCs in central Bangladesh remain limited. Therefore, this study aimed to map the ectoparasitic landscape, estimate the prevalence and intensity of various ectoparasite species, and identify associated risk factors in NDVCs.*

Research Method: *A cross-sectional study involving the systematic examination of 225 NDVCs was conducted. Ectoparasites were collected from NDVCs and identified through direct visual inspection or specific methods used to study the parasites' biology, followed by microscopic identification. The prevalence of ectoparasites and their associations with host age, sex, and season were determined using Chi-square tests and Odds Ratios.*

Findings and Values: *The overall ectoparasite prevalence was 99.11% (223), with six lice and four mite species recorded. The prevalence of Menacanthus stramineus (94.22%), Menopon gallinae (89.78%), Lipeuris caponis (83.11%), Cuclotogaster heterographus (32%), Goniodes gigas (32%), Goniocotes gallinae (29.78%), Knemidocoptes mutans (45.33%), Dermanyssus gallinae (11.56%), Ornithonyssus bursa (11.56%), and Megninia spp. (9.78%). Megninia spp. identified for the first time in Bangladesh. Results showed 65% of chickens had a single lice species, and 45% had mixed infestations. Ectoparasite infestation on the chicken was not linked to age or sex, but showed a significant seasonal difference in mite infestation ($p<0.05\%$). These results provide baseline data on the ectoparasitic burden in NDVCs, highlighting specific parasite threats. Furthermore, the results will aid in developing targeted parasite control strategies to boost the productivity of local NDVCs' farming systems.*

Keywords: *Bangladesh, Ectoparasites, Non-descriptive village chickens (NDVCs), Prevalence, Risk factors.*

INTRODUCTION

Non-descriptive village chickens (NDVCs) are an important part of the livelihoods and food security of rural communities. It also significantly contributes to the protein supply and household income of the village people. Bangladesh has approximately 255.31 million chickens, with about 80% of rural households owning them (Hamid *et al.* 2017).

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The NDVCs' meat and eggs are the most cost-effective and readily available sources of animal protein, which make them accessible to all socioeconomic groups in Bangladesh. Despite their economic and cultural importance, the NDVCs are frequently exposed to a myriad of health challenges, among which ectoparasitic infestations are a major concern. The village chickens forage for resources available in their surroundings, such as insects, seeds, and other types of waste (Permin & Pedersen, 2002). Consequently, they are exposed to a wide range of bacterial, viral, and ectoparasites. Surprisingly, the prevalence of parasite infection in village chickens is estimated to be as high as 100% (Shanta *et al.* 2006, Maxwell *et al.* 2016). The habit of NDVC allows for more freedom of movement throughout their surroundings. It may also increase their exposure to ectoparasitic infestations through contact with the ground, other individuals, or wild birds.

The wide diversity of ectoparasites in local scavenging chickens includes lice, mites, and ticks (Murillo *et al.* 2016, Riwidiharso *et al.* 2020, Shamsi *et al.* 2020). Lice are the most common external parasites of chicken, which belong to the order Mallophaga, the chewing lice, and are characterized by possession of chewing-type mandibles (Calnek *et al.* 1997). Chewing lice feed mainly on feathers, blood, dead skin, or secretions, and they may cause discomfort, decrease in growth and egg production, anemia, irritation, loss of plumage, and skin lesions that may be the site of secondary infection (Clayton *et al.* 2008, Durden 2019). Poultry mites pose a significant threat to the poultry farming sector, affecting both the physiological and psychological health of avian species, as well as the quality of egg production. Moreover, mite also acts as a potential vector transmitting several poultry diseases, introducing secondary infections that affect the poultry's development and survival (Cocciolo *et al.* 2020, Sparagano *et al.* 2022).

Several studies have been conducted in the past to investigate the prevalence of ectoparasites in poultry globally, identifying various species and their impacts across different management systems and geographical regions. For example, research in Ethiopia and Nigeria has reported high prevalence rates of ectoparasites in local chicken breeds, highlighting the widespread nature of this problem (Serda *et al.* 2018). Very few studies have been done regarding ectoparasite infestation in the poultry farming system in Bangladesh (Shanta *et al.* 2006, Shanta *et al.* 2008, Farazi 2017). However, a comprehensive and systematic mapping of the ectoparasitic landscape specifically in NDVCs within Central Bangladesh remains largely undocumented. *Gazipur*, located in central Bangladesh, features a diverse range of environments from crowded industrial areas in *Gazipur Sadar* and *Kaliakoir* to wetland areas in *Kaliganj* and forested zones in *Sreepur.*. Due to the variety in geography and land use, *Gazipur* is a significant area for studying poultry health. The diverse ecosystems in *Gazipur* can impact the health of NDVCs and may also increase their susceptibility to ectoparasite infections. Studying this area can help us to better understand the factors behind infestations and could provide helpful information for controlling parasites in NDVCs across Central Bangladesh and beyond. Therefore, the objective of this study is to identify and estimate the prevalence of ectoparasites in NDVCs and to determine the associated risk factors in the study area.

MATERIALS AND METHODS

Study area and period

The ectoparasites were collected and identified from April 2023 to March 2024 across the five upazilas of *Gazipur* District, Bangladesh (Fig. 1). *Gazipur* is geographically placed between latitudes 23°53' and 24°21' north and longitudes 90°09' and 92°39' east. The five sub-districts (Upazilla) in *Gazipur* are *Gazipur Sadar*, *Kaliakair*, *Kaliganj*, *Kapasia* and *Sreepur.*. Rural household farmers raised the NDVCs for subsistence purposes and the samples were collected from the NDVCs from these five upazilla in *Gazipur* district.

The study duration was categorized into three distinct seasons depending on regional

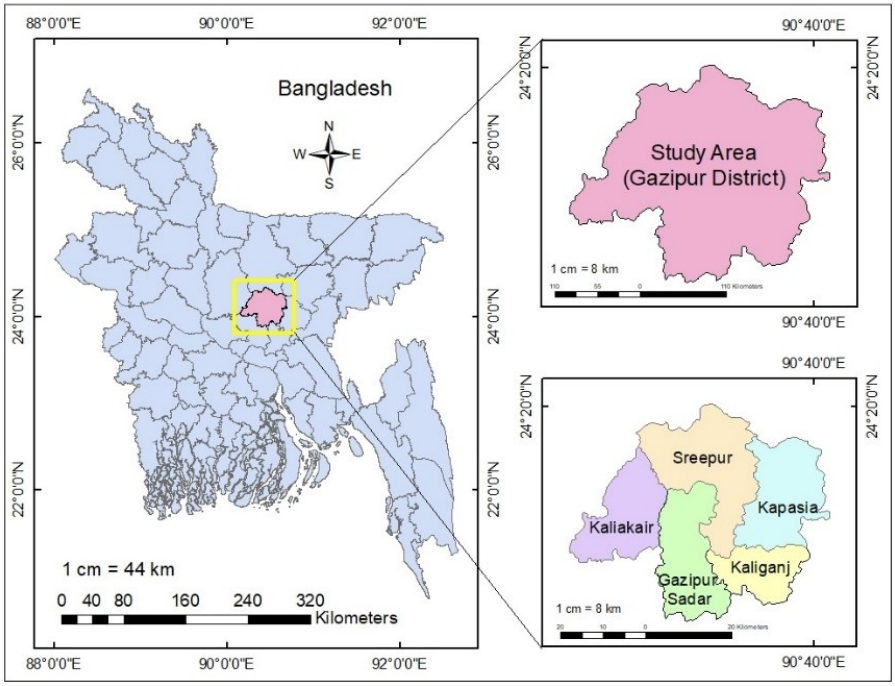

Figure 1. The map visually displays the study area (*Gazipur* district of Bangladesh).

climatic variations: the hot-dry summer season (March to June), the hot-wet rainy season (July to October), and the cool-dry winter season (November to February) (Yasmin *et al.* 2025). All animal experiments were carried out under the experimental animal care and use committee guidelines of the *Gazipur* Agricultural University, Bangladesh (Ref. No. FVMAS/AREC/2023/20).

Study population and sample size determination

The study population consisted of apparently healthy NDVCs (*Gallus domesticus*) of both sexes and various ages (grower: those less than 6 months old; adult: more than 6 months old), raised under different management systems (scavenging: free-range, finding own food; semi-intensive: supplemental feeding with shelter) by individual villagers. For the ease of sampling, the NDVCs were divided into two groups: growers and adults. A total of 225 free-range NDVCs were randomly selected and purchased from households in *Gazipur Sadar* (n = 54), *Kaliganj* (n = 47), *Kapasia* (n = 40), *Kaliakair* (n = 41), and *Sreepur.* (n = 43). The NDVCs were caged and carried to the Parasitology laboratory in the Department of Pathobiology, *Gazipur* Agricultural University, Bangladesh. Furthermore, the sample size was determined using the formula proposed by Thrusfield (Thrusfield 2013, Mahmud *et al.* 2013):

$$n = (1.96)^2 \times P_{exp} \times (1 - P_{exp})/d^2 \quad (1)$$

Where:

- n = required sample size
- P_{exp} = expected prevalence (set at 50% due to the absence of prior comprehensive data for the specific study area, maximizing the sample size for a given precision)
- d = desired absolute precision (set at 0.05 or 5%)
- 1.96 = Z-score for a 95% confidence interval

Based on this calculation, a total of 225 NDVCs were sampled for the study.

Collection and identification of ectoparasites

The NDVCs were sprayed with chloroform and placed in a jar for 10 minutes. After that, the chickens were gently grasped by the shanks and carefully restrained to prevent them from experiencing unnecessary struggle or stress. Then, feathers of different body parts ruffled

towards the opposite direction of its alignment to dislodge the ectoparasites. The lice were collected using forceps on white paper. The collected ectoparasites were preserved in a bottle containing 70% ethanol, labeled with the age and sex of the NDVCs. The featherless areas, such as legs, wattle, combs, and eyelids were thoroughly rubbed to remove mites.

A magnifying hand lens was used for close visual inspection of the swift movement of mites on the white cardboard. The samples were then picked up with forceps after being soaked in water on a microscope slide. Then the slides were mounted immediately with Canada balsam and examined under a light microscope (Fig. 2). After mounting, the ectoparasites were identified based on their morphological characteristics as described (Emerson 1956, Soulsby 1982).

Statistical analysis

The data were input into a Microsoft Excel spreadsheet and subsequently analyzed using the Statistical Package for Social Sciences (SPSS) version 25 (Rahman *et al.* 2025). The incidence of ectoparasites in relation to risk factors, including age, sex, and seasonal variations was analyzed using Fisher's exact test. The odds ratio was used to evaluate risk within groups of identified risk factors, with a 95% confidence interval (CI). A P-value less than 0.05 ($p < 0.05$) was considered statistically significant (Uzzal *et al.* 2021).

RESULTS AND DISCUSSION

Overall prevalence of ectoparasite infestations

The present study provides a comprehensive mapping of the ectoparasitic landscape in NDVCs of Central Bangladesh. Out of the 225 NDVCs examined from the study areas, 222 (98.67%) were infested with lice, 119 (52.89%) with mites, and 118 (52.44%) with both lice and mites, as shown in Fig. 3. The overall prevalence of ectoparasites in NDVCs was 98.67%, slightly higher than the previous study in Bangladesh, reporting 86.67% (3). But similar findings were recorded elsewhere in Nigeria (90.7% and 100%) (Bala *et al.* 2011, Lawal *et al.* 2017), Algeria (69–100%) (Meguini *et al.* 2018), India (97.6%) (Salam *et al.* 2009), Ethiopia (67.71%) (Kebede *et al.* 2017), and Zimbabwe (100%) (Permin *et al.* 2002). The reasons for the higher prevalence of ectoparasites may be linked to poor hygiene and unfavorable environmental conditions that encourage higher ectoparasite loads.

Prevalence and intensity by ectoparasite species

Ten species of different ectoparasites were identified in this study, namely *Menacanthus stramineus*, *Menopon gallinae*, *Lipeurus caponis*, *Cuclotogaster heterographus*, *Goniodes gigas*, *Goniocotes gallinae*, and four species of mites, namely *Knemidocoptes mutans*, *Megninia* spp, *Dermanyssus gallinae*, and *Ornithonyssus bursa* (Table 1, Fig. 2). These findings were consistent with a previous study (Shanta *et al.* 2006), which observed eight different species of ectoparasites. However, most of these species have also been reported from other countries, such as Nigeria (Lawal *et al.* 2017), Ethiopia (Mulugeta *et al.* 2013) and Zimbabwe (Mukaratirwa *et al.* 2009). Among the lice, *Menacanthus stramineus* (94.22%), *Menopon gallinae* (89.78%), and *Lipeurus caponis* (83.11%) were the most prevalent species with high mean intensity, as previously reported (Shanta *et al.* 2006, Kebede *et al.* 2017). In case of mite infestation, *Knemidocoptes mutans* (45.33%) was the most prevalent species, which was also previously reported at 43% (Shanta *et al.* 2006), contrary to findings reported at 5.5% (Shanta *et al.* 2008). The prevalence rate of poultry red mite, *Dermanyssus gallinae* was 11.56%, which is not consistent with 56.5% and 57% (Shanta *et al.* 2006, Farazi 2017). Similar observations were reported in Kenya (13.3%) and Ethiopia (39.3%) (Mungube *et al.* 2008, Kebede *et al.* 2017). The prevalence of *Ornithonyssus bursa* (11.56%) was consistent with the findings of 15.5% (Kebede *et al.* 2017). *Megninia* spp. was the least prevalent species in this study, recorded at 9.78%, and was first reported in Bangladesh. This finding is considered lower than 25% in Indonesia (Riwidiharso *et al.* 2020). Where, NDVCs = Non-Descriptive Village Chickens.

In case of lice infestation, most were infested

Table 1. Prevalence and intensity of ectoparasite species in non-descriptive village chickens (NDVCs) of *Gazipur* district in Bangladesh (N=225).

Ectoparasites encountered	Species	Predilection Site(s)	No. infested	Prevalence (%)	Mean Intensity
Lice	*Menopon gallinae*	Whole body and feathers	202	89.78	15.37
	Menacanthus stramineus	Cloacae, vent, breast, and thighs	212	94.22	18.63
	Lipeurus caponis	Wing feather	187	83.11	8.35
	Cuclotogaster heterographus	Head and neck, especially around the ears and eyes	72	32.00	3.68
	Goniodes gigas	Body feathers, especially the back and breast regions	74	32.89	7.36
	Goniocotes gallinae	Soft down feathers (fluff) all over the body	67	29.78	3.21
Mites	*Knemidocoptes mutans*	Legs and feet (beneath the scales)	102	45.33	Not determined
	Megninia spp	Feathers and feather follicles	22	9.78	
	Dermanyssus gallinae	Vent area, breast, thighs, and crevices	26	11.56	
	Ornithonyssus bursa	Skin around the vent, tail, back, and under wings	26	11.56	

Table 2. Type of ectoparasites infestation in non-descriptive village chickens (NDVCs) in *Gazipur* district of Bangladesh (N=225).

Lice			Mites		
Type of infestation	No. infested	Prevalence (%)	Type of infestation	No. infested	Prevalence (%)
Single	12.00	5.33	Single	70.00	31.11
Double	25.00	11.11	Double	42.00	18.67
Triple	73.00	32.44	Triple	6.00	2.67
Multiple	112.00	49.78	Multiple	1.00	0.44
Non-infested	3.00	1.33	Non-infested	106.00	47.11
Total	225.00	100.00	Total	225.00	100.00

by multiple species (49.78%). In contrast, 32.44%, 11.11%, and 5.33% were infested by triple, double, and single species, respectively. Regarding mite infestation, most samples were infested by a single mite species (31.11%), while 18.67%, 2.63%, and 0.44% were infested by double, triple, or multiple species, respectively (Table 2). The NVDCs were infested with at least one type of lice species throughout the year, and most of the chickens hosted multiple lice species simultaneously (Prelezov *et al.* 2006, Sychra *et al.* 2008, Salam *et al.* 2009, Kaboudi *et al.* 2019). Only lice infestation was more frequent than mixed infestation of both lice and mite. These findings are not in line with those of several authors (Ilyes *et al.* 2013, Tamiru *et al.* 2014, Lawal *et al.* 2017), who reported a higher prevalence of mixed ectoparasitic infection in indigenous chickens. The variances may result from various factors, such as geographical location, climate conditions, the types of parasitological detection methods employed, and sample size. Where, NDVCs = Non-Descriptive Village Chickens.

Association of ectoparasite prevalence with host and management factors

The prevalence of ectoparasites was analyzed in relation to various host and management

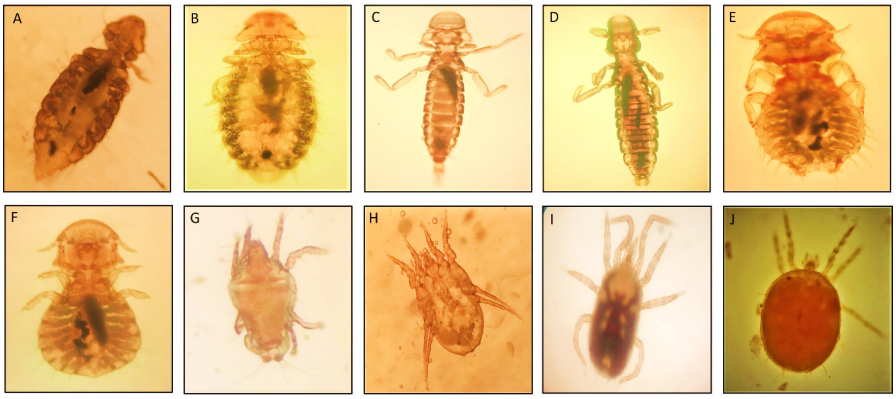

Figure 2. Lice (A–F) and mites (G-J) species identified in non-descriptive village chickens (NDVCs) under microscope. A. Menopon gallinae; B. Menacanthus stramineus; C. Lipeurus caponis; D. Cuclotogaster heterographus; E. Goniodes gigas; F. Goniocotes gallinae; G. Knemidocoptes mutans; H. Megninia spp; I. Dermanyssus gallinae; J. Ornithonyssus bursa.

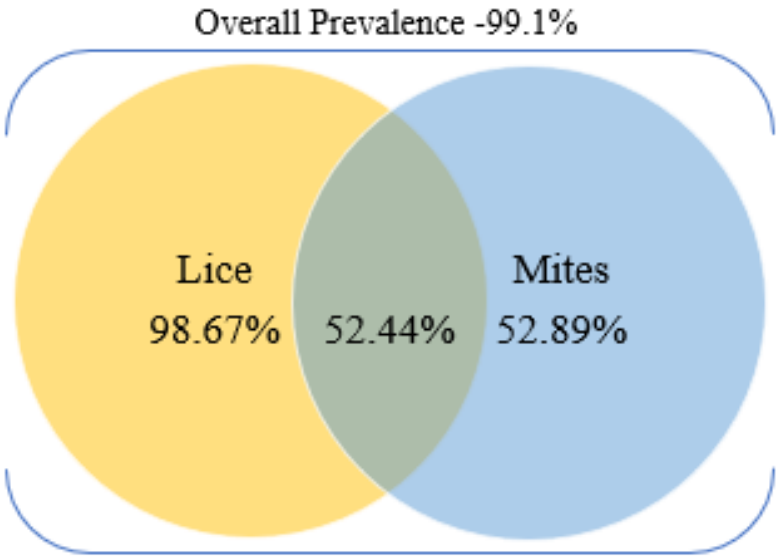

Figure 3. Prevalence of overall ectoparasites infestation of non-descriptive village chickens (NDVCs) in *Gazipur* district of Bangladesh (N=225).

Table 3. Prevalence of non-descriptive village chickens (NDVCs) ectoparasite (lice) and its association with hypothesized risk factors in *Gazipur* district of Bangladesh (N=225).

Factors	Categories	No. examined	No. infested (Prevalence-%)	OR	95% CI	χ^2/Fisher	p-value
Sex	Male	120	118 (98.33)	1	0.16–19.7	0.22	0.64
	Female	105	104 (99.05)	1.76			
Age	Grower	117	115 (98.29)	1	0.17–20.8	0.26	0.61
	Adult	108	107 (99.07)	1.86			
Season	Summer	67	65 (97.01)	–		2.38	0.30
	Rainy	86	85 (98.84)	–			
	Winter	72	72 (100)	–			
	Total	225	222 (98.67)				

factors, and the results of statistical comparisons are presented in Tables 3 and 4. This study revealed a non-significant difference (P>0.05) in the prevalence of lice and mite infestation in NDVCs when sex and age were considered as hypothesized risk factors. In this study, female NDVCs (lice: 99.05%; mite: 55.24%) were more infested than the males (lice: 98.33%; mite: 51.67%), although the difference was not significant (P>0.05). This nonsignificant difference between the sexes signifies that the male and female NDVCs share the same pen and have an equal chance of infestation. The high prevalence of ectoparasites in female NVDCs may be linked to their stationary incubation period, which increases susceptibility if the pen harbors ectoparasites (Zeryehun *et al.* 2015). This finding is consistent with previous studies (Biu *et al.* 2007, Sabuni *et al.* 2011, Malann *et al.* 2016, Nahal *et al.* 2021). However, a higher infestation rate was recorded in male than female chickens, with a statistically significant difference (Mungube *et al.* 2008).

* Indicates (P<0.05) a significant relationship between the mite infestation and season of NDVCs.

Where, NDVCs = Non-Descriptive Village Chickens; OR = Odds Ratio; CI = Confidence Interval; χ^2 = Chi-square.

The findings showed that adult NDVCs (lice: 99.07%; mite: 58.33%) were more susceptible to ectoparasite infestation than growers (lice: 98.29%; mite: 48.72%) (Tables 3 and 4). These outcomes are also consistent with previous research (Biu *et al.* 2007, Malann *et al.* 2016), but are inconsistent with the results reported by Tamiru *et al.* (2014). The ectoparasite infestation in adult NDVCs was higher compared to the grower, which may be due to adults scavenging more in wider areas and mingling with other poultry or animals. The adults NDVCs experience prolonged exposure to infested environments, resulting in a higher prevalence.

Additionally, current results indicated that lice were mainly prevalent throughout the year. But mite infestation was significantly (P<0.05) prevalent during the summer season (67.16%) compared to the rainy season (53.49%) and the winter season (38.89%). The prevalence of mite was found to be positively correlated with temperature, being higher in summer, followed by spring, and lowest in winter (Nadeem *et al.* 2007, Mungube *et al.* 2008). Moderate to high ambient temperature and humidity of summer are essential for egg hatching and larval development (Soulsby 1982).

Geographical distribution of ectoparasites

Gazipur, situated in central Bangladesh, encompasses diverse ecosystems, including forests in *Sreepur.*, water bodies in *Kaliganj* and *Kapasia*, and densely populated heavy industrial zones in *Gazipur Sadar* and *Kaliakair*. Spatial

Table 4. Prevalence of non-descriptive village chickens (NDVCs) ectoparasite (mites) and its association with hypothesized risk factors in *Gazipur* district of Bangladesh (N=225).

Factors	Categories	No. examined	No. infested (Prevalence-%)	OR	95% CI	χ^2/Fisher	p-value
Sex	Male	120	61 (51.67)	1	0.71–2.02	0.44	0.51
	Female	105	58 (55.24)	1.19			
Age	Grower	117	57 (48.72)	1	0.46–1.32	0.84	0.36
	Adult	108	62 (58.33)	0.78			
Season	Summer	67	45 (67.16)	–		11.16	0.004*
	Rainy	86	46 (53.49)	–			
	Winter	72	28 (38.89)	–			
	Total	225	119 (52.89)				

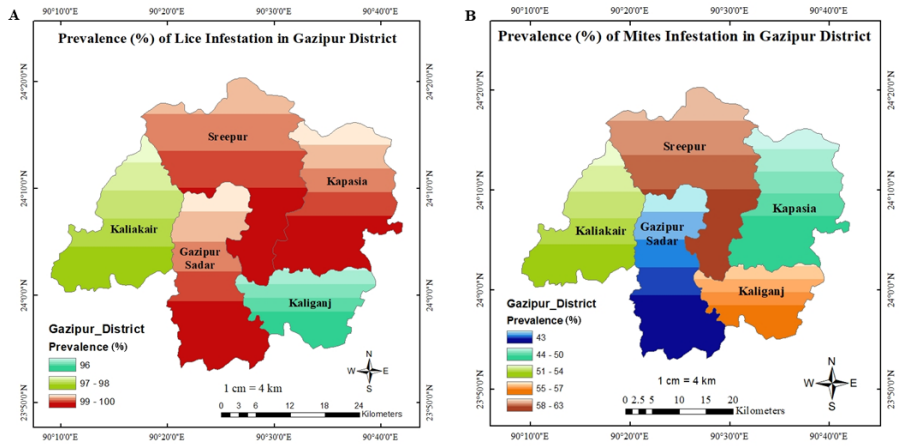

Figure 4. Spatial patterns of lice (A) and mites (B) infestation in non-descriptive village chickens (NDVCs) of five upazila in the map of *Gazipur* district of Bangladesh (N=225).

patterns of lice and mite infestation in NDVCs of five upazila in the map of *Gazipur* district of Bangladesh were shown in (Fig. 4). Spatial analysis highlights a notable ectoparasitic burden in *Kaliganj*, with high prevalence rates of lice (96%) and mites (57.45%).

In contrast, *Kaliakair* appears less at risk, thanks to its urban lifestyle and better veterinary access, reducing its vulnerability. This aligns with previous findings (Mulugeta *et al.* 2013), which indicated rural chickens are more prone to ectoparasites than urban ones. Mite infestations are also more common in *Sreepur*, where the forested, humid, and densely vegetated environment favors mite growth. These findings are important not only for documentation but also for understanding the species involved and identifying at-risk host groups. Furthermore, the results provide a crucial baseline for addressing a widespread health issue affecting NDVCs in the region.

CONCLUSION

The present study successfully mapped the ectoparasitic landscape in NDVCs of central Bangladesh. The research also provided critical baseline data on the prevalence, intensity, and associated risk factors of ectoparasite infestations. The ectoparasites were highly prevalent in NDVCs because they were raised under traditional scavenging systems and received exposure to infested environments. Additionally, the ectoparasites posed a significant constraint, resulting in health issues, reduced productivity, and economic losses. Currently, the NDVCs are likely to continue

increasing in popularity due to their low-cost maintenance, ease of management, and higher disease resistance capabilities. Therefore, future investigations should build upon these findings to explore seasonal dynamics, evaluate control measures, and further elucidate the complex host-parasite interactions in this vital poultry population.

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