Prevalence of Mites of Backyard Chicken in South-West Bangladesh

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MY BELOVED PARENTS

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CERTIFICATE

This is to certify that the thesis entitled **'Prevalence of Mites of Backyard Chicken in South-West Bangladesh'** submitted to the Department of Microbiology and Parasitology, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of **Master of Science** in **Parasitology**, embodies the result of a piece of bonafide research work carried out by **Md. Abdullah Farazi**, Registration number: **17-08239** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that any help or source of information, received during the course of this investigation has duly been acknowledged.

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ACRONYMS AND ABBREVIATIONS

ABBREVIATION	FULL MEANING
et al.	And others/ Associates
X^2	Pearson Chi-square.
KOH	Potassium hydroxide
SPSS	Statistical software for Social Sciences
M.S.	Master of Science

Prevalence of Mites of Backyard Chicken in South-West Bangladesh

ABSTRACT

In Bangladesh, chicken meat is an important source of protein for rural people. Chicken production also plays a vital role in the socio-economic development of the country. However, mite infestations are among the important hindrance in the development of this industry. Chicken mites suck blood and give irritation to the chicken. As a result, chicken become anaemic, emaciated and lose their production. A study was carried out on backyard chicken from January 2018 to December 2018 to determine the prevalence and identify the species of mites in South-West Bangladesh. Among 200 backyard chicken (37 male and 163 female), 173 (86.5%) were infested. Four mite species, including *Dermanyssus gallinae* (56.5%), *Ornithonyssus sylviarum* (15.5%), *Ornithonyssus bursa* (9%) and *Knemidocoptes mutans* (5.5%), were found in the backyard chicken. The high prevalence of mites in backyard chicken indicates that mite infestation is a common problem in South-West Bangladesh. Therefore, awareness should be made among the producers and adequate preventive measures should be taken to control mite infestation inorder to gain optimum chicken production.

Keywords: Prevalence, Mite, Backyard chicken, Bangladesh.

Chapter I

Introduction

Chapter II

Review of Literature

Chapter III

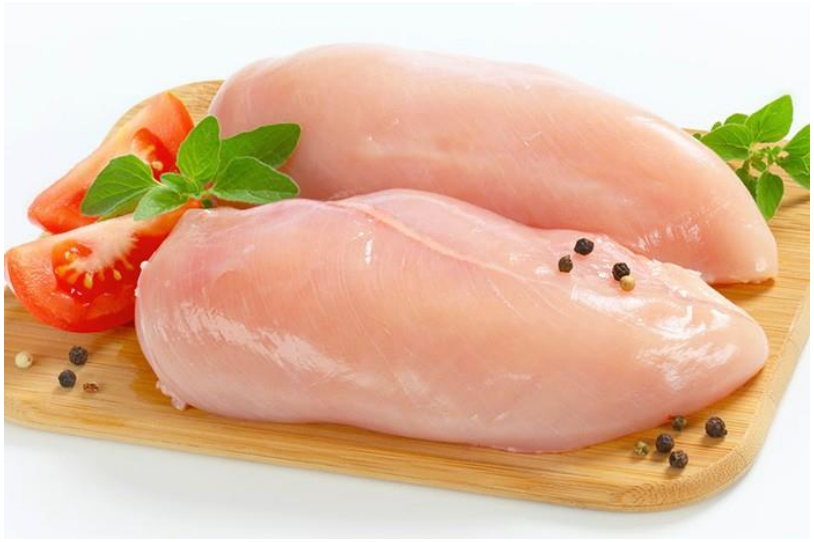
Materials and Methods

Chapter IV

Results and Discussion

Chapter V

Summary and Conclusion



References

CHAPTER 1

INTRODUCTION

Chicken is one of the most commercial and profitable animal production industries in the Tropics (Obiora, 1992). Much development in poultry sector of Bangladesh occured in the last three decades. Rural backyard chicken, though still contributing to the national egg production, are still the most mistreated one. Like other animals, backyard chicken suffer from different types of diseases. Backyard chicken constitutes one of the significant components of the nutritional status and income of many smallholder farmers and landless society (Maqbool *et al.,* 1998; Permin *et al.,* 2002; Muchadeyi *et al.,* 2004). Compared to a number of other livestock species, fewer social and religious restriction are related to the production, marketing and consumption of chicken products. For these points, chicken products have become one of the most important protein sources throughout the world (Radfar *et al.,* 2012). Additionally, Backyard chicken play an effective role in pest control and are used for common ceremonies and festivals (Kelly *et al.,* 1994; Muchadeyi *et al.,* 2004). Furthermore, backyard chicken can be reservoirs for a number of parasitic infections and transmit their parasites to other birds. Parasitic infections of backyard chicken represent health and economic problems as well as sources of infection for commercial chicken, wild birds and man (Eslami *et al.,* 2009).

Traditional chicken production is often expressed as a low input/low output system. The low productivity is mostly caused by diseases, lower management and lack of supplementary feed (Muchadeyi *et al.,* 2004). Among the various ectoparasites of domestic bird, the mites are of considerable importance despite their small size. In the rural areas, chicken is found to be infested with different species of mites (Abedin and Huq, 1977; Rahman *et al.,* 1989). The mites decrease the reproductivity of the chicken, and heavy infestation may weaken them and lower their resistance. They suck blood, and give continuos irritation, and thus they causes emaciation, anaemia and eventually loss of production. In some cases, severely affected birds may die (Soulsby, 1982).

The mites commonly found in chicken are *Dermanyssus gallinae, Ornithonyssus sylviarum, Ornithonyssus bursa, Neocnemidocoptes gallinae, Knemidocoptes mutans, Trombicula alfreddugesi, Laminosioptes cysticula, Megninia cubitalis, M. ginglymura, Pterolichus obtusus.*

Chicken mites act as a vector. *Dermanyssus gallinae* causes major pathogenic diseases (Desloire *et al.,* 2006) such as salmonellosis, avian spirochaetosis and *Erysipelothrix rhusiopathiae* (Chirico *et al.,* 2003). It also transmits different pathogens like Eastern, Western, and Venezuelan equine encephalitis viruses, fowl poxvirus, and the bacteria *Salmonella enteritidis, Pasteurella multocida, Coxiella burnetii,* and *Borrelia anserina.*

Dermanyssus gallinae is an ectoparasite which is called red mite of chicken. Despite its common names, it has a wide range of hosts including several species of wild birds and mammals including humans (Sparagano *et al.*, 2014). The mites usually feed around the breast and legs of hens, causing pain, irritation, and a decrease in egg production. The northern fowl mite, *Ornithonyssus sylviarum* is found in several continents and has been reported as the major pest of poultry. Though *O. sylviarum* predominantly a nest-parasite of wild birds, this obligate hematophagous mite is a permanent ectoparasite on domestic birds, especially egg-laying chickens (Murillo and Mullens, 2017). Infestation can cause a reduction in egg production, egg weights, and feed conversion efficiency (Giuseppe Vezzoli *et al.*, 2016). The mite *Ornithonyssus bursa* (Berlese, 1888) (Mesostigmata: Macronyssidae) is known as the tropical fowl mite that mainly parasitizes wild and domestic birds (Denmark and Cromroy, 2003) . It is a species of mite (Ewe*n et al.*, 2009). It is a mite of brooding hen, but also has been found to bite humans and two species of mammals namely bandicoot and gerbil (Berlese, 1888). It usually lives in birds' feathers. Tropical fowl mites undergo five stages during their development: egg, larva, protonymph, deutonymph, and adult. During the last two stages, they suck blood from their host for food (Shapiro and Leo, 2012). *Knemidocoptes mutans* are small, spherical and mange mites of avian hosts and are members of Order Acarina, Suborder Astigmata (Sarcoptiformes) and the Family Sarcoptidae (Soulsby, 1982). Adult female *K. mutans* has short and stumpy legs. All legs do not have any tarsal suckers. *K. mutans* is known as scaly leg mite that burrows under the scales of chicken's legs and spends its entire life cycle of 1 to 2 weeks on the bird. It causes purulent dermatitis, hyperkeratosis and acanthosis in the skin of affected legs (Shanta *et al.*, 2006) It is rare in modern chicken facilities. It is usually found on older birds.

Backyard chicken with mite infestation causes health and economic problems as well as sources of infection for industrial chicken, wild fowls and man (Eslami *et al.*, 2009). Unfortunately, there are a very few works on the prevalence of mites in backyard chicken through detail morphological studies in Bangladesh. Therefore, the objectives of the present study were

1. to carry out the morphological identifications of mites in backyard chicken.
2. to determine the prevalence of mite infestation in backyard chicken from South-West Bangladesh.

CHAPTER 2

REVIEW OF LITERATURE

Assefa *et al.* (2017) conducted a study in Ethiopia on Prevalence of Ectoparasites of Poultry in and Around Jimma Town. In this study, (8.85%) chicken were found to have mites on their body surface, subcutaneous tissue or the legs. Two species of mites (*Knemidocoptes mutans, Dermanyssus gallinae*) were found to be the post prevalent parasites in Jimma and surrounding areas. The occurrence of mites was less in adult chicken (4.17%) compared to young grower chicken, (4.68%). These parasites had a higher frequency of occurrence in females (5.2%) than males (3.64%). It was higher in local chicken (5.98.0%) than exotic chicken (2.86%) as well as higher in intensively managed chicken (6.51%) than extensively managed chicken (2.34%).

Eladl *et al.* (2018) conducted a study that was carried out on six laying hen farms, three mite-infested and three mite-free at Dakahlia and Damietta governorates in Egypt. The results showed that 12 mite species were detected in the mite-infested farms, this is the first record in Egypt, and that *Dermanyssus gallinae* was the highest identified species from 295 (40.9%) of 720 samples. There was a significant effect ($P \leq 0.05$) of mites on the mortality, feed consumption, egg production and the tested haematological parameters.

Hoglund *et al.* (1995) conducted a study from May to December 1994 to investigate the prevalence of hematophagous mites in Sweden. A particular aim was to establish the relationship between occurrence of mites and certain types of production systems for egg layers. Initially a postal questionnaire study was performed. Some months later this was followed up by inspections, sampling, and interviews on farms. The only mite species found was the red poultry mite, *Dermanyssus gallinae*. Although this species was found to be present in cage batteries, deep-litter systems, and backyard flocks, it was less prevalent among birds housed in cages. About 4% of the cage systems were found to be affected both according to the results of the postal inquiry and from the field study.

Lawal *et al.* (2016) conducted a cross sectional study on the prevalence of ectoparasites of village chickens and its associated economic significance in Gombe, Northeastern Nigeria. A total of 1025 village chickens were examined out of which 90.7% were infested with one or more ectoparasites species. Four types of ectoparasites genera were encountered in this study, 17.0% of the total chickens examined were infested with only one genera while 73.9% were infested with two or more different genera. Among the ectoparasites encountered, lice infestation (85.8%) was the most prevalent followed by mite (70.4%), Flea (27.3%) and tick (6.2%) in descending order of prevalent. They found four mite species, namely *Dermanyssus gallinae, Epidermoptes species, Laminosioptes cysticola, Megninia species*.The findings of this study showed that ectoparasites infestations are highly prevalent among village chicken flocks, which may likely affect their optimum productivity. This may be associated with inadequate husbandry systems, poor hygiene practice, inadequate control and preventive measures among others. Therefore, routine prevention and control of ectoparasites should be

encouraged in the study area. Moreover, campaigns to create awareness and educate poultry farmers on the economic significance of ectoparasitism in village chickens productivity should be organized in Gombe State.

Fermin *et al.* (2002) conducted a cross-sectional study on the prevalence of ecto-, endo- and haemoparasites in free-range chickens from the Goromonzi District, Zimbabwe. They found *Knemidocoptes mutans* in young (6%) and adult (32%). The prevalences of *K. mutans,* were higher in adults compared to young chickens.

Mamatha *et al.* (2018) studied a survey on incidence of tropical fowl mite infestation in poultry layers and humans. They examined 70,000 commercial layer birds housed in raised platform system with 17,500 birds each in four poultry sheds were severely infested with mites at a Koppal district in Karnataka state. The infested birds were showing symptoms of restless, pale comb and wattles, intense scratching and decreased hen day egg production by 4%. In working personnel, intense itching with erythematic skin lesions were observed on hands, legs and neck region with a lot of discomfort due to crawling nature of mites. The nests and the dust accumulated on drinking water pipelines and the feeder supporting stands in the poultry sheds were collected, processed and examined for the presence of mites. Based on the standard morphological characters, the mites were identified as *Ornithonyssus bursa*. An insecticide, Malathion dusting and spraying was advised to birds and to poultry sheds, including drainage pipelines along with oral administration of ivermectin during evening hours.

Murillo *et al.* (2016) conducted a survey on Diversity and Prevalence of Ectoparasites on Backyard Chicken Flocks in California.Peridomestic ("backyard") chicken flocks are gaining popularity in the developed world (e.g., North America or Europe), yet little is known regarding prevalence or severity of their ectoparasites. Therefore, five birds on each of 20 properties throughout southern California were surveyed in summer for on-host (permanent) and off-host dwelling (temporary) ectoparasites. Three parasitic mite species were observed: *Ornithonyssus sylviarum* (Canestrini & Fanzago) (15%), *Knemidocoptes mutans* (Robin & Lanquetin) (10%), and *Dermanyssus gallinae* (De Geer) (5%). Parasite diversity in peridomestic flocks greatly exceeds that is routinely observed on commercial chicken flocks and highlights a need for increased biosecurity and development of ectoparasite control options for homeowners.

Murthy *et al.* (2016) stated that five poultry farm buildings of Vikarabad area of Rangareddy district were visited. Samples were collected from a variety of sites, including beneath feed troughs, inside cage fittings and fastening clips, under egg conveyer belts and under manure belts. Heavily mite infested feathers were plucked from three to five individual birds and kept in closed plastic covers. Samples were processed and mounted permanently by using DPX and species differentiation was done. Besides this litter materials and soil samples from the farm were also collected. Massive mixed infestations of *Dermanyssus* and *Ornithonyssus* mites were found. Mites, lice, fleas, and ticks were confirmed as the common types of ectoparasites affecting poultry. Mites were the most common (43%) followed by lice (40%), fleas (37%) and ticks (2%).

Njunga (2003) conducted a study on Ecto- and haemoparasites of chickens in Malawi with emphasis on the effects of the chicken louse, *Menacanthus cornutus* . He found that overall lice had the highest frequency of occurrence, with a 100% prevalence in the free-range production system closely followed by the 95% mite infestation (*K. mutans)*. There was significantly ($p< 0.0001$) higher prevalence of *K. mutans* among older chickens compared with young ones.

Odenu *et al.* (2016) reported on Ecto-parasites of Domestic Chickens (*Gallus gallus domesticus)* in Gwagwalada Area Council, Abuja, Nigeria-West Africa and examined 327 birds (local birds, turkeys and exotic birds) for the presence of ectoparasitic infestation. They found that 18 (7.26%) birds were infested with mites (*Knemidocoptes mutans*).

Oche *et al.* (2016) conducted a study on ecto-parasites of local chickens in Benue State, Nigeria. In this study total of 294 local chickens were examined and 414 (69.70%) were infested with ectoparasites. Four groups of ectoparasites (lice, flea, ticks and mites) were found infesting chickens in this study. Three species of mites, namely *Knemidocoptes mutans* (18.18%), *Knemidocoptes gallinae* (11.45%), *Dermanyssus gallinae* (3.20%) were found. The overall prevalence of mites was 32.83%. Female chickens were 33.53 ($p < 0.001$) times more likely to be positive for ectoparasites than male. This may be associated with inadequate husbandry systems, poor hygiene practice, inadequate control and preventive measures among others. In conclusion, there was a high prevalence of ecto-parasites in free range local chickens in Benue State.

Rezaei *et al.* (2014) conducted a survey on Prevalence of ectoparasites in free-range backyard chickens, domestic pigeons (*Columba livia domestica*) and turkeys of Kermanshah province, west of Iran. This study was carried out on free-range backyard chickens, domestic pigeons (*Columba livia domestica*) and turkeys from May 2012 to April 2013 to determine the prevalence and identify the species of ectoparasites in Kermanshah province, west of Iran. Of the total of 600 free-range backyard chickens (185 ♂ and 415 ♀), 700 domestic pigeons (278 ♂ and 422 ♀) and 150 turkeys (53 ♂ and 97 ♀), 389 (64.83 %), 608 (86.85 %) and 54 (36 %) were infected with one or more parasites respectively. Three species of mites (26.33 % *Dermanyssus gallinae*, 8.5% *Ornithonyssus bursa*, 7% *Cnemidocoptes mutans*) were found in the backyard chickens. The domestic pigeons were infected *D. gallinae* (8.28 %). The mite species recorded in turkeys were *D. gallinae* (12.66 %), *C. mutans* (6 %).

Razmi *et al.* (2008) conducted a study that was aimed to determine abundance and body distribution of PRM in laying hens of Arak. A total of 1400 laying hens were randomly examined from January to June 2008. Of those, 26 (92.86%) layer farms were found to be infested with *Dermanyssus gallinae* (39.3%). There was significant association between prevalence and climatic conditions of the region. The most common predilection site of PRM was significantly cloak (52.7%) and the highest mixed infestation rate was 10.9% for wing-breast and cloakbreast of examined poultries. It was concluded that PRM infestation was low and predilection sites of infestation may affect egg laying capacity.

Sabuni *et al.* (2010) conducted a syudy on prevalence of ectoparasites infestation in indigenous free-ranging village chickens in different agro-ecological zones in Kenya. They found 74.3% mite infestation. They found five species of mites, namely *Dermanyssus gallinae* (7.5%), *Knemidocoptes mutans (66.4%)*, *Epidermoptes species* (83.2%), *Laminosioptes cysticol* (1.9%) and *Megninia species* (3.7%).

Serda and Abdi (2018) conducted a study on ectoparasites in poultry in Etiopia. They observed two important orders of mites. Order Acarina accounts 15.10% from overall 384 chicken examined for ectoparasites. However, Order Arachnida was the least one in percentage, which was only about 2.2%. The prevalence of the former one was higher in local (15.6%), peri urban (16.6%), extensive (16%), male (15.2%) and young (23.00%) than exotic (13.16%), urban (12.90%), semi intensive (5.88%), female (7.14%) and adult (13.11%) age groups respectively. But the later one was higher in exotic (2.63%), urban (1.94%), extensive (20%), female (1.98%) and adult (1.97%) than local (1.62%), peri urban (1.75%), semi intensive (0%), male (1.52%) and young (1.3%) respectively.

Shanta *et al.* (2006) studied on the prevalence of ectoparasites on backyard poultry, 300 poultry of both sexes and different ages were examined in a infested with one or more species of ectoparasites. Two species of mites namely *Dermanyssus gallinae* (57%) and *Knemidocoptes mutans* (43%) were identified. In broody hens, prevalence of *D. gallinae* was the highest (97.3%). *K. mutans* (43%) was mostly found in adult poultry aged above two years.

Tamiru *et al.* (2014) conducted a study on Prevalence of Ectoparasite Infestation in Chicken in and Around Ambo Town, Ethiopia. They randomly selected 390 chickens and simultaneously recorded Age, sex, breed and management system of the study population. They collected ectoparasites from different parts of the body including shank scraping and identified with stereomicroscopy or light microscopy. An overall 67.95% (265/390) prevalence was recorded and five species of ectoparasites under three orders (Phthiraptera (lice), Siphonaptera (flea) and mite were identified. They found the prevalence of mite (*Knemidocoptes mutans*) 34.62%.

Zeryehun and Yohannes (2015) conducted a study that was carried out to determine the prevalence and types of ectoparasite faunas and the associated host-related risk factors in free scavenging chickens in Wolayita Zone, Southern Ethiopia. They found three genera and seven species of ectoparasites in this study. Of the three genera, mites were the dominant ones (24.9%) followed by lice (13.8%) and ticks (1.3%). Among the seven species of ectoparasites, Knemidocoptes mutans (61.1 %) was the most prevalent species followed by *Cuclotogaster heterographus* (8.9%) and *Menopon gallinae* (8.9%); *Goniocotes gallinae* (8.3%) and *Menacanthus stramineus* (8.3%), while Argaspersicus 3.3%(6/180) was the least identified. There was no significant difference ($p>0.05$) in prevalence of ectoparasites with regard to sex, age and breeds of chickens except for *Knemidocoptes mutans* which was more significantly ($p<0.05$) prevalent in adults than growers and chicks, in local than exotic breeds, and in female than male chickens.

CHAPTER 3

MATERIALS AND METHODS

3.1. Field study area

This study was conducted from January 2018 to December 2018 in the South-West Bangladesh on backyard chicken obtained from in and around four selected areas namely Khustia, Jessore, Khulna, and Bagerhat.

Figure 1: Map of South-West Bangladesh showing the study area in large rectangular shape.

3.2. Sample size and sampling procedure

A total of 200 backyard chicken of different age and sex groups were randomly selected from the area under study. The chicken 2–8 months old were considered to be “young”; those older were considered to be “adult”. The head, combs, eyelids, wattles, neck, feathers, breast, back, wings, shafts, legs and other external surfaces of the poultry were methodically examined for mite.

Figure 2: Backyard poultry affected with different types of mite species.

3.3. Study Methodology

The feathers of the head, neck, wings, body, legs and cloaca were raised and thoroughly examined with naked eyes, and using magnifying glass for mites. In birds suspected to infestation with mites, deep scrapings were collected by using a scalpel and dipped in 70% alcohol. Each chicken examined was assigned with serial number and labelled with the necessary information attached to the sampling vial for easy identification. The data of each chicken like sex, age and predilection sites were recorded in separate sheet. Wet film was prepared from the scrap for mite suspected samples and 10% potassium hydroxide (KOH) was added to digest debris, and examined under light microscope. The rest mites were identified according to morphological characteristics using entomological keys with the consultation of standard books (Soulsby, 1982; Urquhart *et al.*,1996; Wall and Shearer, 2001 and Williams, 2010).

3.4. Data Managements and Statistical Analysis

Data were coded and entered in to Microsoft Excel spread sheet and calculated using Statistical software for Social Sciences (SPSS) version 22.0. The data were thoroughly screened for errors and completely coded before subjecting to statistical analysis and analyzed using the Pearson chi-square (x^2) test to determine the association present among the different variables. Infestation of mites in sex, age and breed with their relative prevalence were calculated. Frequency was used to calculate the load of different species of parasites. In all cases, $P< 0.05$ were set for significance. Finally, descriptic statistics were used to summarize part of the data.

CHAPTER 4

RESULTS AND DISCUSSION

RESULTS

Through examination of different body parts of 200 backyard chicken four mite species were recovered from 173 infected chicken. The mite species were *Dermanyssus gallinae, Ornythonyssus bursa, Ornythonyssus sylviarum* and *Knemidocoptes mutans.*

4.1. Morphological observations of detected mites

4.1.1. Morphology of *Dermanyssus gallinae* (Red mite of chicken)

The results of the study showed the backyard chicken were infected some mites that had eight jointed legs (Schmidt and Gunther, 1993) (Fig.1A). This indicates the characteristics of the class of Arachnida. The chelicerae were long, chelate, with terminal scissor-like processes. The palpi were developed. The body was usually soft, milk-colored, covered by one or more weakly-sclerotized to brown shields (or plates). Eyes were absent (Krantz *et al.*, 2009) (Fig.1B). These are the characteristics of the Order Mesostigmata. Idiosoma was broadly rounded posteriorly. The single dorsal shield found with prominent shoulder (Di Palma *et al.*, 2012) (Fig.1C). Setae were present on the posterior part of the body (Baker, 1999) (Fig. 1F). These are the character of the Family of Dermanyssidae. Lack of setae on the dorsal plate. Sternal shield narrowed, distinctly wider than long (Di Palma *et al.*, 2012) (Fig. 1D). These are the character of the Genus *Dermanyssus*. This mite had long legs and usually a grayish- white body. The anal shield was relatively large and was at least as wide as the genitoventral plate (Di Palma *et al.*, 2012) (Fig. 1E). This is the character of the species of *Dermanyssus gallinae*.

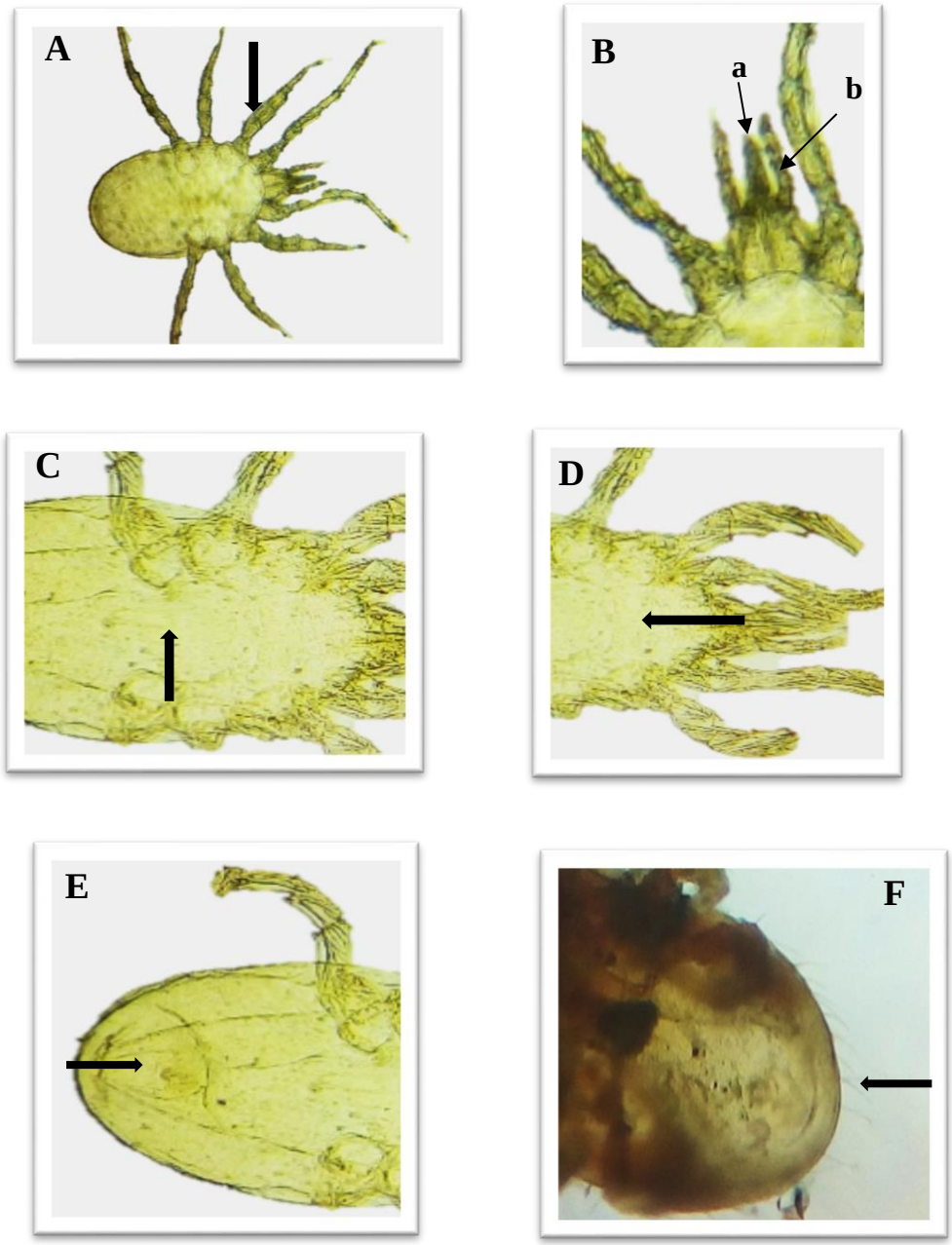


Figure 3: Different body parts of *Dermanyssus gallinae*, A: Eight jointed legs. B: Mouth parts indicates chelicerae (a) and palp (b). C: Dorsal plate. D: Sternal plate. E: Anal plate. F: Setae on the posterior part of the body (arrow).

4.1.2. Morphology of *Ornithonyssus sylviarum* (Northern fowl mite)

This mite beared eight jointed appendages (parts that are attached to the main body), a segmented (divided into parts) body and a well-developed head (Schmidt and Gunther, 1993) (Fig. 2A). These morphological character match with the class of Arachnida. The body was covered by one or more weakly-sclerotized to brown plates. Eyes were absent (Krantz *et al.*, 2009) (Fig. 2A). These are the characteristics of the order Mesostigmata. Dorsal plate was broad, not completely covering dorsal surface (Fig. 2B). This is the feature of the Family of Macronyssidae. Genitoventral plate was narrowed posteriorly behind the legs (Fig. C). Sternal plate was rectangular (Berlese, 1888) (Fig. 2D). These special morphological characters are the equivalent to the Genus *Ornithonyssus* and the species of *Ornithonyssus sylviarum.*

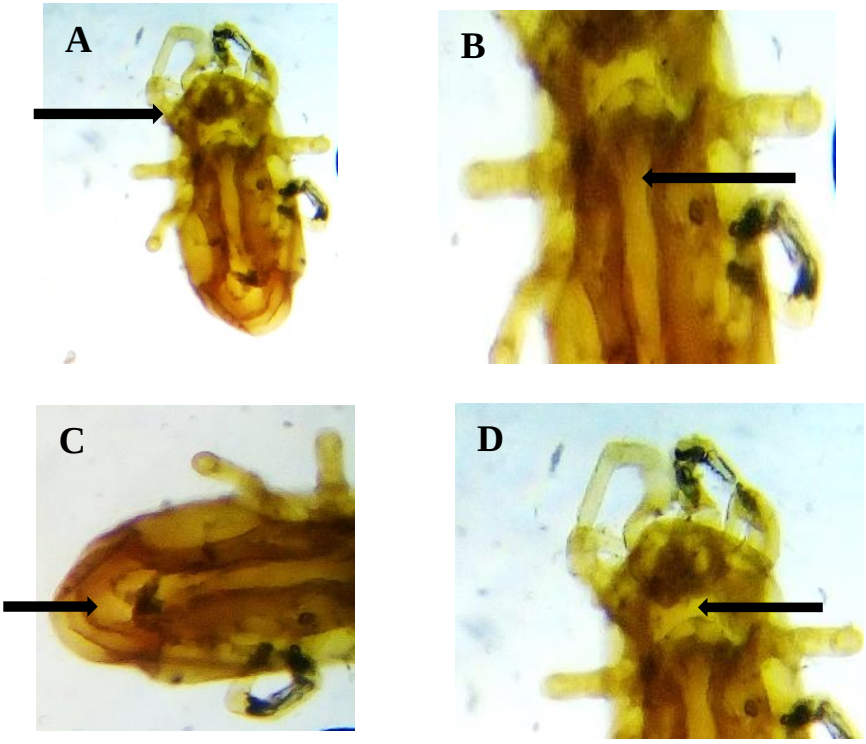


Figure 4: Different body parts of *Ornithonyssus sylviarum*, A: paired, jointed appendages a segmented body and a well-developed head. Body is covered with brown plate. B: Dorsal plate. C: Genitoventral plate. D: Sternal plate (arrow).

4.1.3. Morphology of *Ornithonyssus bursa* (Tropical fowl mite)

The mite had eight jointed appendages (Schmidt and Gunther, 1993) (Fig. 3A). This is the characteristics of the class of Arachnida. The body was found by one or more weakly-sclerotized to brown plates. There were no eyes. (Fig. 3A). (Krantz *et al.,* 2009) These morphological characteristics are similar with the Order of Mesostigmata. Dorsal plate was broad, not completely covering dorsal surface (Di Palma *et al.,* 2012). This is the character of the Family Macronyssidae. Among four pairs of legs, only three pairs of legs were located on the sternal plate (Fig. 3B) Towards its posterior end, its body was narrows slightly. Posterior end of dorsal plate was more evenly (Berlese, 1888) (Fig. 3C). These are the features of the Genus *Ornithonyssus* and the species of *Ornithonyssus bursa.*

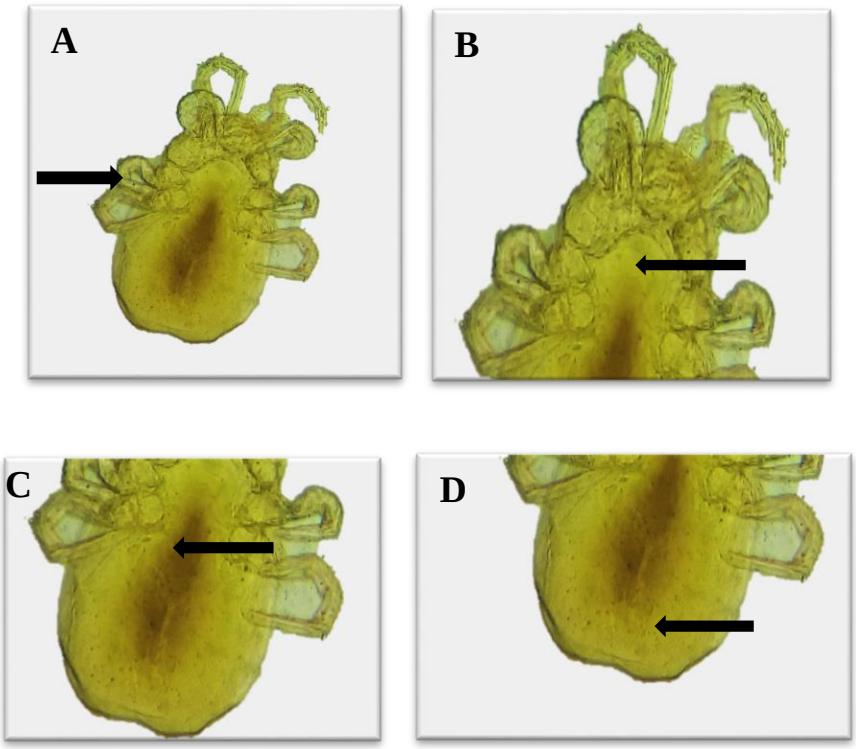


Figure 5: Different body parts of *Ornithonyssus bursa.* A: Paired joint legged appendages. Body is covered with brown plate. B: Sternal plate possessing 3 pairs of legs. C: Dorsal plate. D: Anal plate (arrow).

4.1.4. Morphology of *Knemidocoptes mutans* (Scaly leg mite)

This mite had jointed leg (Schmidt and Gunther, 1993) (Fig. 4A). This is the characteristics of the class of Arachnida. It had a range of specialized modified sensory setae (Fig. 4B) which is the character of the Order Acariformes. The dorsal surface was covered by faint striations which were broken in a plate or scale like pattern mid-dorsally (Fig. 4C). The body had no spines or scales (Wall and Shearer, 2012) (Fig. 4D). These are the characteristics of the Family of Knemidocoptidae. It was very small mite with oval body and short leg (Fig. 4A). These morphological features are same to the Genus *Knemidocoptes* and the species of *Knemidocoptes mutans.*

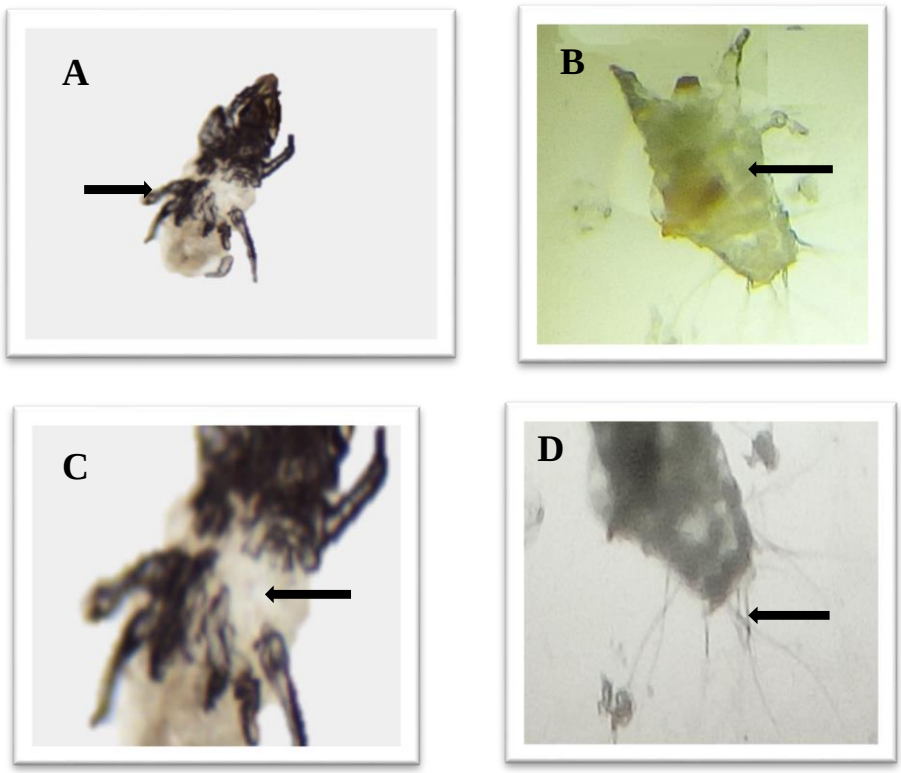


Figure 6: Different body parts of the *Knemidocoptes mutans*, A: Paired joint legged appendages. B: Small mite with oval body. C: Body without spines or scales. D: Modified sensory setae (arrow).

4.2. Prevalence

4.2.1. Overall prevalence of mite infestation in backyard Chicken

Out of the 200 backyard chicken examined, 173 chicken (86.5%) were found to be infested with different species of mites. (Table 1, Figure 7). Regarding species of mite of backyard chicken in the present study, four species were identified namely *Dermanyssus gallinae, Ornithonyssus sylviarum, Ornythonyssus bursa* and *Knemidocoptes mutans. D. gallinae* was the most prevalent (56.5%) while *Knemidocoptes mutans* was the least (5.5%). *Ornithonyssus sylviarum* (15.5%) was the second most prevalent species infesting chicken followed by *Ornithonyssus bursa* (9%) (Table 2).

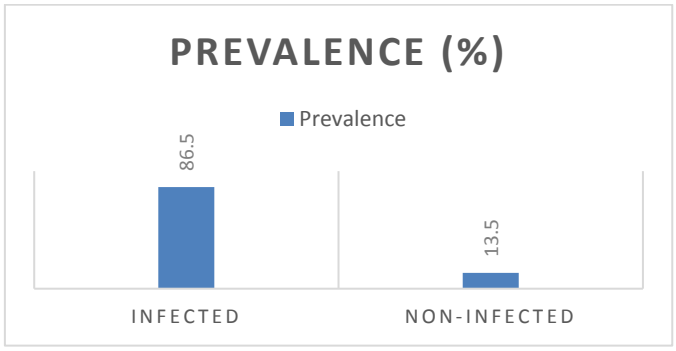


Figure 7: Overall prevalence of mite infestation in backyard chicken.

Sex – wise prevalence reveals females having very higher prevalence of 95.09 % compared with the males 48.65%, and this variation was statistically significant (χ^2 =55.70; p<0.05). In the age wise prevalence, adult chicken (91.67%) were more infested than young (73.21%) with a statistically significant variation (χ^2 =11.76; p<0.05). There were more mites in the wet season (93.79%) than in the dry season (73.23%), and this difference was statistically significant (χ^2 =16.58; p<0.05).

The prevalence of mite infestation was significant (p < 0.05) among backyard chicken of different risk factors (age and sex). The prevalence of mite infestations among backyard chicken examined in the present study revealed that 86.5% of the observed chicken were found mite infested. This result reveals a high mite infestation rate among backyard chicken in South-West Bangladesh.

Table 1. Overall prevalence of mite infestation according to sex, age and seasons in backyard chicken in South-West Bangladesh. (n = 200)

Variable		No. Examined	No. positive	Prevalence (%)	χ^2 (p-value)
Sex	Male	37	18	48.65	55.70 (0.000)*
	Female	163	155	95.09	
Age	Young	56	41	73.21	11.56 (0.001)*
	Adult	144	132	91.67	
Season	Wet	129	121	93.79	16.58 (0.000)*
	Dry	71	52	73.23	
Total		200	173	86.5	

* indicates significant (P< 0.05)

X^2 = Pearson Chi-square.

4.2.2. District wise prevalence of mite infestation in backyard chicken

All backyard chickens were examined from four district- Jessore (60), Khulna (55), Bagherhat (35), Kustia (50). The recorded number of infested backyard chickens were 47 in Jessore, 50 in Khulna, 31 in Bagherhat and 45 in Kustia. Among four district the prevalence of mite infestation in backyard chicken was highest in Khulna district (90.91%) and lowest in Jessore district (78.33%). The prevalence of mite infestation in backyard chicken was 90% in Kustia district and 88.57% in Bagherhat district (Figure : 8).

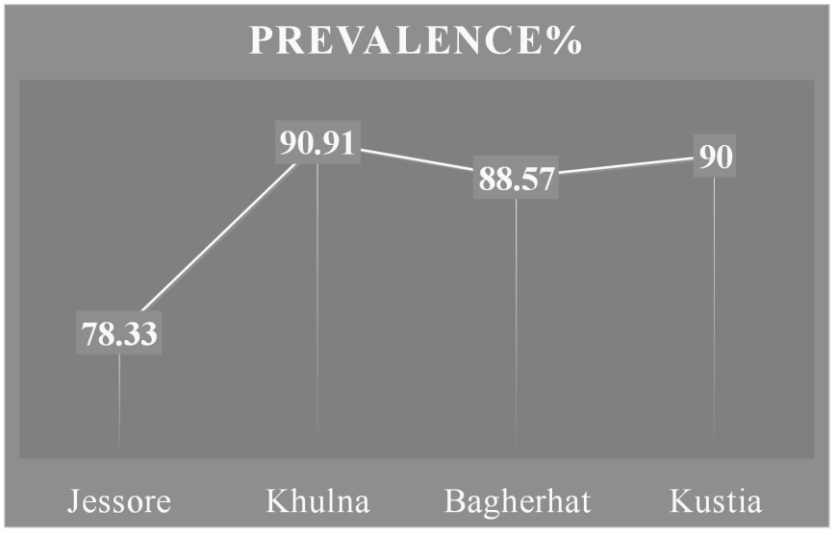


Figure 8: District wise prevalence of mite infestation in backyard chicken

4.2.3. Prevalence of individual species of mites by age of chicken

Among four species of mites the prevalence of *Dermanyssus gallinae* was higer in both adult and young chicken than that of the other species. The prevalence of *Dermanyssus gallinae* in young and adult chicken were 51.78% and 58.33%, respectively. The prevalence of *Ornithonyssus sylviarum* in young and adult chicken were 12.5% and 5.36%, respectively. The prevalence of the *Ornithonyssus butrsa* in young and adult chicken were 16.67% and 10.42%, respectively The prevalence of *Knemidocoptes mutans* in young (12.5%) and adult chicken (16.67%) was lowest among all species of mite recovered (Table 2).

Table 2. Prevalence of individual species of mites by age of chicken.

Species of mite	**Age of the host**	**No. of host examined**	**No. of host infected**	**Prevalence (%)**
D. gallinae	Young	56	29	51.78%
	Adult	144	84	58.33%
	Total	200	113	56.50%
O. sylviarum	Young	56	07	12.50%
	Adult	144	24	16.67%
	Total	200	31	15.50%
O. bursa	Young	56	03	05.36%
	Adult	144	15	10.42%
	Total	200	18	09.00%
K. mutans	Young	56	02	03.57%
	Adult	144	09	06.25%
	Total	200	11	05.50%

4.2.4. Prevalence of individual species of mites by sex of chicken

The prevalence of *Dermanyssus gallinae* was higest in both male (29.73%) and female (62.58%) poultry. The prevalence of *Ornithonyssus sylviarum* in male and female poultry were 10.81% and 5.41% respectively. The prevalence of *Ornithonyssus bursa* in male and female poultry 16.56% and 9.2%, respectively. The prevalence of *Knemidocoptes mutans* in male poultry (2.70%) and female poultry (6.13%) was lowest among all species of mite recovered. (Table 3).

Table 3: Prevalence of individual species of mites by sex of chicken**.**

Species of mites	Sex of the host	No. of host Examined	No. of host Infested	Prevalence (%)
Dermanyssus gallinae	Male	37	11	29.73
	Female	163	102	62.58
Ornythonyssus sylviarum	Male	37	4	10.81
	Female	163	27	16
Ornythonyssus bursa	Male	37	2	5.41
	Female	163	16	9.2
Knemidocoptes mutans	Male	37	1	2.70
	Female	163	10	6.13

4.2.5. Prevalence of mite infested backyard chicken according to predilection sites

Among 173 infested backyard chicken mites were recovered from wings (18), feathers (41), body surfaces (103) and legs (11). The prevalence of mites were 10.41% on wings, 23.69% on feathers, 59.53% on body surfaces and 6.36% on legs. The number of mites were high on body surfaces and low on legs (Figure : 9).

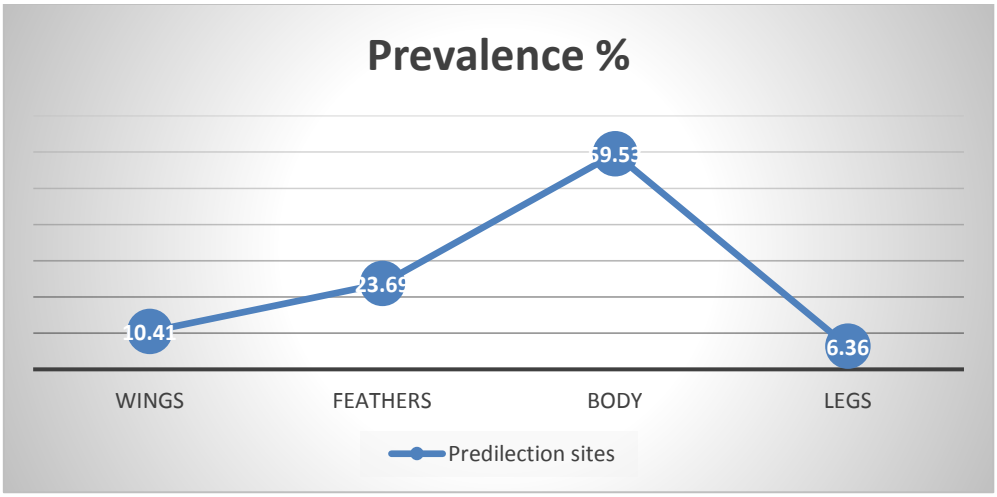


Figure 9: Predilection sites wise prevalence of mite infestation in backyard chicken

DISCUSSION

In this study, the overall prevalence of mites in backyard chicken was 86.5% considerably higher than 7.26% recorded in Nigeria (Odenu *et al*., 2016), 8.85%in Ethiopia (Assefa *et al*., 2007), 24.9% in Ethiopia (Zeryehun and Yohannes, 2015), 34.62% in Ethiopia (Tamiru *et al*., 2014), 32.83% in Nigeria (Oche *et al*., 2016), 43% in Hyderbad (Murthy *et al.*, 2016) which indicates that mite infestation is a common problem in this area. Similar observations with varying prevalence 74.3% reported in Kenya (Sabuni *et al.*, 2010), 70.4% in Nigeria (Lawal *et al*., 2016). Moreover, higher prevalence than the present study was 95% reported in Malawi (Njunga, 2003). The high prevalence recorded in this present study of mites may be associated partly with the poor sanitation and hygienic practice in the backyard management system, which creates a conducive environment for the propagation and life cycle progression of the diverse mites in the studied area. The high mite infestation has direct or indirect effects on the productivity of local chickens. Scavenging nature of the backyard chickens may cause mite infestations that are origin of other chicken species or wild birds (Adelusi *et al.*, 2014). The variation in the prevalence reported in the present study and other previous similar studies elsewhere might be attributed several significant factors such as the variation in method of study, sample size, sampling period, village chicken husbandry and management system, breed or ecotypes of chickens, climatic and seasonal variation, agro ecological, the study location with respect to urban, peri-urban or rural settlements and implemented methods of the ectoparasitic diseases control and prevention (Banda, 2011) in the various study areas.

The present study revealed a significant difference in the prevalence of mite infestation in backyard chicken when age was considered as one of the hypothesized risk factors. The findings revealed that adult (91.67%) backyard chicken are significantly more infested by mite than young (73.21) chicken. This support similar report by Biu *et al.* (2007), Malann *et al.* (2016); Oche *et al.* (2016) and Kebede *et al.* (2017) who have also reported that adult village chickens were more infested by mites compared with younger ones. The high prevalence of mites in adult chickens compared to the young ones might possibly be associated with the fact that adult poultry scavenge through a wider area mixing with other species of poultry or animals and maybe exposed longer to the infested environment and other source of infestation than the young poultry, hence a higher prevalence. However, our finding is inconsistent with those of Mulugeta *et al.* (2013) and Firaol *et al.* (2014) who reported that young chickens were more infested with mites compared to the adult poultry.

The result of the present study showed that the female (95.09%) backyard chicken are more infested than the male (48.65%) ones, and this difference was significant. Moreover, the high prevalence of mites in the female backyard poultry may be associated with the stationary state of the females during incubation of eggs which allows the female chicken to be more susceptible to mite infestations if the pen is harboring the mite fauna. This finding is consistent to those of Biu *et al.* (2007); Bala *et al.* (2011); Malann *et al.* (2016); Oche *et al.* (2016) in Nigeria, Mohammad *et al.* (2016) in Iran, Kebede *et al.* (2017) in Ethiopia who reported a higher occurrence of mite infestation in hens compared to in cockerels and roosters. However, higher infestation rate observed in male than female chickens with presence of statistical significance difference have been reported by Mungube *et al.* (2008); Belihu *et al.* (2010) and

Firaol *et al.* (2014). There are conflicting reports on the impact of host sex on prevalence of chicken mites.

In this study, all the backyard chicken in the wet and dry seasons harboured mites with a prevalence of 93.79% in the wet season and 73.23% in the dry season. The mite infestation was more in wet season than the dry season. Similar findings have been reported in village chicken by Permin *et al*. (2002) in Zimbabwe, by Sabuni *et al.* (2010) and by Chege *et al.* (2015) in Kenya. In the wet season, chicken remain together for warmth which could facilitate the spread of the mite. The high prevalence in the wet season could also be explained by permanent housing during the planting season when the backyard chicken are confined (Chege *et al.,* 2015).

In the present study, four species of mites were found in backyard chicken in South-West Bangladesh. *Dermanyssus gallinae* (56.5%) was the most prevalent followed by *Ornithonyssus sylviarum* (15.5%), *Ornithonyssus bursa* (9%) and *Knemidocoptes mutans* (5.5%). The finding that the prevalence of *D. gallinae* (56.5%) was more or less similar as Shanta *et al.* (2006) who found 57% prevalence in *D. gallinae* but was higher than 26.33% reported by Rezaei *et al.* (2016) and 7.03% by Kebede *et al.* (2017) in Ethiopia, 39.3% by Razmi *et al.* (2008) in central Iran, 43.45 % by Yakhchali *et al*. (2013) in northeastern Iran and 30.7 % by Othman *et al.* (2012) in northern West Bank, Palestine. The finding was lower than 100% reported by Cencek (2003) in Poland, 60% by Magdas *et al.* (2006) in Romania, 67% by Hoglund *et al.* (1995) in Sweden. Poor management was the main cause of this high prevalence. It was hypothesized that the variation in the prevalence rates of these mites species as reported from various studies could be attributed to different husbandry and management system of the chickens, climate, geo-ecology of the study areas, different season of sampling, sample size and the study location with respect to urban or rural areas.

The prevalence of *K. mutans* (5.5%) had the least prevalence concurs with the findings of 7% reported by Rezaei *et al.* (2016), 7.26% by Odenu *et al.* (2016) and 9.40% by Bala *et al.* (2011) but higher than 0.57% reported by Moyo *et al.* (2015) The finding is lower than the finding of 95% reported by Njunga (2003), 43% by Shanta *et al.* (2006), 34.62% Firaol *et al.* (2014) and 18.18% by Oche *et al.* (2016), who found more prevalence of *K. mutans* than the present study. The variation in prevalence of *K. mutans* is likely to be due to agro climatic differences between the study areas, season of study, geogerafic difference and control measure against *K. mutans* in these areas. The prevalence of *Ornithonyssus sylviarum* (15.5%) was lower than Wang *et al.* (2010) who found 46.9% prevalence of *Ornnithonyssus sylviarum.* The prevalence of *Ornythonyssus bursa* (9%) was higher than Rezaei *et al.* (2016) who found 8.5% prevalence of *Ornithonyssus bursa.* These variations in the prevalence may be due to different factors such as farm sizes, endemic situation and poor hygiene practices (Yakhchali *et al.,* 2013). Most of the cases, *Ornithonyssus bursa* are found in brooding hens.

This study showed that higest number chickens (95.53%) were infested by mites on body surfaces and least number chickens (6.36%) were infested by mites on legs. Maximum mites namely *Dermanyssus gallinae* and *Ornythonyssus sylviarum* suck blood from host. Blood found more from body than other predilection sites. For this reason, Large number of mites were recovered from body surfaces of backyard chickens.

Generally, four species of mites were identified in the present study indicating the existence of diverse mites in the study area. The current study indicates that backyard chicken are considered as potential reservoirs for mite infestations and this causes a risk of contamination for modern chicken farms. Therefore, further studies are needed to illuminate the economic and hygiene impacts of multiple mite infestations on chicken reared in backyard system.

CHAPTER 5

SUMMARY AND CONCLUSION

Chicken provides a valuable protein to the diets of people world- wide and is an important source of egg production. Chicken mites play an important role in the transmission of certain pathogens which cause heavy economic losses to chicken industry in addition to direct effect of causing morbidity by sucking blood and causing irritation to the chicken. The present study demonstrated the high infestation of mites of backyard chicken in South-West Bangladesh with overall prevalence of 86.5%. The prevalence of mites in female (95.09%) was higher than male chicken (48.65%). The prevalence of mites in adult (91.67%) was higher than young poultry. Mite is the common type of ectoparasites in the study area. Among the four species of mite identified *Darmanyssus gallinae* and *Ornythonyssus sylviarum* were the most common species in the study area. The other species *Ornythonyssus bursa* and *Knemidocoptes mutans* were found with least prevalence. The occurrence of mite infestations found was influenced by a number of factors like age, sex, breed. Local breed, female and adult poultry were found highly infested as compared to exotic breed, male and young chicken. Chicken mites causes irritation, loss of weight, skin lesions that may be site of secondary infection, sucking blood, hence leading to anemia and death at times. Mite (*D. gallinae*) act as mechanical or biological vectors transmitting a number of pathogens. *O. sylviarum* is distinguished from *D. gallinae* by the genitoventral plate and dorsal plate Genitoventral plate is attenuate and narrowly rounded posteriorly in *O. sylviarum* and broadly rounded posteriorly in *D. gallinae*. Dorsal plate of *O. sylviarum* is abruptly narrowed posteriorly and more smoothly narrowed in *D. gallinae*. In case of *O. bursa*, among four pairs of legs, only three pairs of legs were located on the sternal plate and towards its posterior end, its body was narrows slightly. *K. mutans* is identified with the morphology of modified sensory setae and short jointed legs.

This study revealed high mites burden in backyard chicken of the current study area which demands serious efforts to decrease the problem. High infestation of parasites can be reduced by a well-planned management of chicken, emphasizing on hygiene and suitable environment around the chicken farm and awareness creation to the farmers and farms staffs. It was concluded that, use of specific chemicals in the approved manner may also help the chicken farmers in the control of mites. Therefore, control of these mites and enlightenment campaign to the chicken rearers on the dangers resulting from mite infestation on chickens should be instituted. Further studies are needed to identify more species and genus of chicken mites circulating in this area and to the direct and indirect economic losses of mite infestations in the area.

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