Ectoparasites Infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

Jallailudeen Rabana Lawal1, Zainab Bukola Yusuf2, Jamila Dauda3, Yagana Ahmed Gazali4, Abdullahi Abubakar Biu5

1Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.  
2Department of Veterinary Surgery and Radiology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.  
3Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.  
4Department of Veterinary Anatomy, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.  
5Department of Veterinary Parasitology and Entomology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.

*Corresponding author: Jallailudeen Rabana Lawal, Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.

ABSTRACT

A cross sectional study on the prevalence of ectoparasites and associated risk factors in village chickens was conducted in Potiskum Area of Yobe State between February, 2016 to November, 2016. Out of 400 village chickens of both sexes and ages that were examined, 338 (84.50%) were infested with ectoparasites. Four fauna of ectoparasites namely lice, flea, ticks and mites were found infesting village chickens at different predilection sites on the bodies of the infested chickens in this study. The most prevalent species of ectoparasites identified was Lipeurus caponis (40.25%) followed by Menacanthus stramineus (14.0%), Echidnophaga gallinacea (8.75%), Cnemidocoptes mutans (7.0%), Cnemidocoptes gallinae (5.0%), Argas persicus (4.50%), Menopon gallinae (2.75%) and Dermanyssus gallinae (2.25%) in a descending order. Results also revealed that 9.0% and 75.50% of the affected village chickens were infested with single and mixed species of ectoparasites. The difference in prevalence rate of ectoparasites in adult chicken (61.75%) was higher than in younger (22.75%) ones. The finding in age group showed that there was a statistical significant differences (P<0.05) in prevalence rate of ectoparasites infestation between adult and young chickens. The prevalence of ectoparasites was higher in female (46.25%) than in the male (38.25%); higher in village chickens reared under extensive management (64.75%) system than those reared under semi-intensive (19.75%) system. Ectoparasites infestation was found to be higher in village chickens sampled from the rural (56.25%) settlements than those sampled from the semi-urban (28.25%) settlements of the study area. There was no statistical significant difference (P>0.05) between male and female chicken, extensive management and semi-intensive managements systems as well as between rural and semi-urban settlements. Results of this study revealed that ectoparasites prevalence rate was higher during the rainy (49.0%) season than in the dry (35.50%) season of the sampling period. The finding in season showed that there was a statistical significant differences (P<0.05) in prevalence of ectoparasites between rainy and dry season. In conclusion, there is a high prevalence of ectoparasites in free range village chickens in Potiskum Area of Yobe State, therefore, adequate control and preventive measures should be put in place to curb the effect of the parasites on the productivity of village chickens.

Keywords: Ectoparasites, Village chickens, infestation, Potiskum, Yobe State;

INTRODUCTION

Poultry production plays significant socio-economic roles in developing countries and it is one area of livestock production with significant contribution to human nutritional status in many developing countries in Africa (Assefa et al., 2017). The poultry production system also play
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

an important role in poverty alleviation and job creation for the most vulnerable women and young people especially in the rural areas (Akintunde et al., 2007; Wilson, 2010; ILRI, 2014). Poultry edible products (meat and eggs) has indeed become one of the most important protein sources for man throughout the world due to limited social and religious taboos related to their production, marketing and consumption compared to products from other livestock species such as beef and pork (Beyene et al., 2014; Mohammed and Sunday, 2015). Poultry production is being subjected to great pressure to satisfy the demand for animal protein required by the continued increase in human population and also to have surplus for international trade (FAO, 2008; Firaol et al., 2014; Sambo et al., 2015). The poultry production system can broadly be classified into two which consist of the exotic/commercial poultry and the rural/village poultry production systems (Odenu et al., 2016). These two poultry production systems involved the rearing of various species of domesticated and semi domesticated birds species meant for diverse importance of human livelihoods. Various domesticated poultry species such as ducks, turkeys, guinea fowl, quail, pigeons and chickens are important in village poultry production system. However, the chickens are the most dominance in terms of population and popularity (Acamovic et al., 2005; Nyoni and Masika, 2012). They are considered as one of the most widely distributed poultry species and forms an important agricultural activity available to most rural dwellers in most developing countries including Nigeria (Akintunde et al., 2015; Lawal et al., 2015; Mohammed and Sunday, 2015).

Village chickens have also been reported to be used for traditional sacrifices, ceremonies, festivals in some cultures and have played an active role in pest control (Alders et al., 2007), hence, they contribute significantly to the livelihoods of the most vulnerable rural households (Nyoni and Masika, 2012). The village chickens constitute the majority of the chicken population in Northern Nigeria and are mainly kept under extensive management system where they roam freely and scavenge for food (Musa et al., 2008). Their movement is uncontrolled and they hardly receive any prophylactic treatment or vaccination against common poultry disease (Duru et al., 2008; Musa et al., 2008). Unfortunately, wide arrays of constraints affects the benefits derived from village chickens and its products in rural Nigeria of which suboptimal management, low genetic potential, poor housings, minimal veterinary care, inadequate supplementary feeding problem both in quality and quantitative terms, predation, accidents, theft and high morbidity and mortality rate due to the menace of various disease are to be considered (El-Yuguda et al., 2005; Nwanta et al., 2008; Bettridgea et al., 2014). High losses of village chickens due to diseases pose a serious threat to food security and livelihood of many rural families in Northern Nigeria (Musa et al., 2008), especially those states afflicted by rapid population growth due to unconditioned influx of insurgency displaced people. The prevalence of various diseases are considered the most important factor limiting the maximum productivity of the village chicken in Nigeria (Akintunde and Adeoti, 2014; Mohammed and Sunday, 2015). Among the diseases affecting adequate and maximum productivity of village chickens, the effects of parasitic infection plays an important role (Yeshitila et al., 2011; Nafyad et al., 2015). However, ectoparasites have been identified as the major impediment to chicken health worldwide owing to the direct and indirect losses they cause (Permin et al., 2002; Swai et al., 2007). Ectoparasites infestation can affect chicken health directly by causing irritation, discomfort, tissue damage, blood loss leading to anaemia, toxicosis, allergies and dermatitis, which in turn alleviate quality and quantities of meat and egg production (Bala et al., 2011; Hobbenaghi et al., 2012; Desoky et al., 2015; Zeryehun and Yohannes, 2015). In addition, they act as mechanical or biological vectors transmitting number of pathogens such as Rickettsial, bacterial and viral diseases which may result to serious health derailment in chickens and even human population (Bala et al., 2011; Asresie and Eshetu, 2015; George et al., 2015). Several species of ectoparasites such as the flies, lice, mites, and ticks can infest and live on domestic chickens (Yacob et al., 2009; Firaol et al., 2014; Angieryeyi et al., 2015). Several studies have analyzed the prevalence of ectoparasites infestation in village chickens in different parts of the Northern Nigeria (Bala et al., 2011; Usman et al., 2012; Agbede, 2013; Audi and Asmau, 2014) including the Northeastern Nigeria States (Biu et al., 2012; Lawal et al., 2016). However, despite these various surveys on the prevalent of ectoparasites in village chickens in the northeastern, Nigeria, there is dearth of information on the prevalence of
ectoparasites of village chickens in Yobe State, Northeastern Nigeria. The present study therefore was designed to determine the prevalence of ectoparasites of village chickens and their associated risk factors in and around Potiskum, Yobe State, North eastern Nigeria. It is hoped that the results of this study could be used in making objective decisions in the control strategies of ectoparasites infestation in the study area.

MATERIALS AND METHODS

Study Area

Potiskum is a Local Government Area in Yobe State, Nigeria on the A3 highway at 11°43′N11°04′Elt has an area of 559 square kilometers (216 sq mi) and a population of 205,876 at the 2006 census.

Study Population

The apparently healthy village chickens of both sexes and various age groups reared under different management systems that are owned by individual farmers were considered as a study population. Farmers consent to scrap/brush skin samples from their chickens were sought, as farmers were formally enlightened so as they understand the significance of the study. The chickens were examined for the absence or presence of ectoparasites infestation. Aging was considered on the bases of young and adult chickens for convenience of sampling.

Study Design

A cross sectional study was conducted to determine the prevalence of ectoparasites infestation in village chickens in the study area. Households that reared village chickens and are willing to participate in the research were randomly selected to be inclusive. Households were also selected based on the history of no previous use of any form of insecticides on birds. Selected households were visited at least twice during the stipulated study period.

Sample Size Determination

The sample size of the village chickens of both sexes and ages required for this study was calculated using the equation given by Thrusfield (2005) for simple random sampling in research. Sample size was determined using 95% level of confidence; since there was no previous work in this study area 50% expected prevalence and 0.05% desired absolute precision were considered. From this calculation, 384 samples were arrived at, but to be on the safest sides of sampling a total of 400 village chickens were examined.

Physical Examination and Sample Collection

Selected village chickens were gently grabbed by the shanks and manually restrained with caution not to allow the chicken go through neither unnecessary struggle nor stress. Physical examination for ectoparasites infestations was carried out by quickly but gently flubbing the feathers of any selected chickens towards the opposite direction of its alignment. The whole body of each chicken was thoroughly examined to assess the presence of ectoparasites by using close visual inspection and magnifying hand lens. During sample collection, ectoparasites that stocked to the body of affected chicken were collected by hand picking and while others were collected by gentle brushing of the skin onto a white cardboard paper. Each collected samples from individual chickens were preserved separately in a sample bottle containing 70% of alcohol and then labeled appropriately for onward transportation to the Department of Veterinary Parasitology and Entomology Research laboratory, University of Maiduguri where further identification will be carried out.

Microscopy Examination

Samples were conveyed to the University of Maiduguri, Department of Veterinary Parasitology and Entomology Research laboratory for identification of the ectoparasites by stereomicroscopic examination. Parasites were further examined, identified and confirmed under the microscope by a more experienced entomologist after comparing their morphology with identification keys.

Data Analysis

The data generated from the study was coded and then entered into Microsoft excel spread sheet and was analyzed using STATA version 11.0. The prevalence of ectoparasites in relation to the risk factors such as age, sex, management, settlement and season were analyzed using chi
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

RESULT

Out of the 400 village chickens of both sexes and different age groups examined for ectoparasites infestation in the study area, 338 with an overall prevalent rate of 84.50% were found to be infested with lice (order: Mallophaga), fleas (order: Siphonaptera), mites and tick. Among the ectoparasites encountered, Lice were the most predominant with prevalent rate of 57% followed by mites (14.25%), flea (8.75%) and the ticks is the least predominant with prevalent rate of 4.50% (Table 1).

A total of 8 different species of ectoparasites were encountered at various predilection sites of the affected village chickens. These include three species of lice, three species of mites, one species of flea and one species of ticks. The three species of lice identified were Lipeurus caponis (40.25%) which were predominantly found on the feathers, Menacanthus stramineus (14.0%) found on the thigh and breast region and Menopon gallinae (2.75%) found on the fluff/shafts of the feathers of the neck, back, abdomen, wings and areas near cloaca. Echidnophaga gallinacea (8.75%) was the only species of flea identified and was found on the Comb, wattles, eye lids and around ears. Argaspersicus (4.50%) was also the only species identified and was found on the abdominal area and below wings. The three species of mite identified were Cnemidocoptes mutans (7.0%) and Cnemidocoptes gallinae (5.0%) which were both found on shank and toes of legs, and Dermanyssus gallinae (2.25%) found around the wings and breast of the affected birds. Of all the ectoparasites encountered, Menopon gallinae was the most predominant species with a prevalent rate of 40.25% while Dermanyssus gallinae was the least prominent species with a prevalent rate of 2.25% (Table 2).

Affected village chickens were found to harbor single, double or multiple ectoparasites infestation. Out of the 338 (84.5%) village chickens affected, 36 (9.0%) were found to harbored single species of ectoparasites, 210 (52.5%) harbored double species of ectoparasites while 92 (23.0%) were found to harbor more than two species of ectoparasites (Table 3).

Prevalence of the ectoparasites infestation was found to be statistical significantly higher in adult (61.75%) than in young (22.75%) chickens (P= 0.0198). The prevalence of ectoparasites infestation was relatively higher in females (46.25%) than in the males (38.25%), although there was no statistically significant (P = 0.3481) difference observed in the rate of infestation among the sexes. The results of ectoparasites infestation in village chickens reared under different management system revealed that infestation was high in chickens reared under absolute free range extensive management system (64.75%) than in chickens reared semi-intensively (P = 0.1003), there was also no statistically significant (P = 0.3481) difference observed in the rate of infestation among the two management systems. The prevalence of ectoparasites infestation was higher in village chickens examined in the rural areas (56.25%) when compared to infestation rate of chickens examined in the semi-urban (28.25%) settlement of the study area, although there was no statistically significant (P = 0.1768) difference observed in the rate of infestation among the village chickens examined in the different settlements. The prevalence of ectoparasites infestation was relatively higher in rainy season (49.0%) compared to in dry season (35.50). Statistically, there was significance (P = 0.0362) difference between the two seasons (Table 4).

<table>
<thead>
<tr>
<th>Ectoparasites</th>
<th>Number of chickens infested(N=400)</th>
<th>Prevalence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lice</td>
<td>228</td>
<td>57.0</td>
</tr>
<tr>
<td>Flea</td>
<td>35</td>
<td>8.75</td>
</tr>
<tr>
<td>Tick</td>
<td>18</td>
<td>4.50</td>
</tr>
<tr>
<td>Mites</td>
<td>57</td>
<td>14.25</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>84.50</td>
</tr>
</tbody>
</table>

Key: N = Total number of village chickens examined during the study period
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

Table 2. Prevalence and predilection sites of ectoparasites infestation in village chickens (Gallus gallus domesticus) in Potiskum, Yobe State, Nigeria.

<table>
<thead>
<tr>
<th>Ectoparasites encountered</th>
<th>Species</th>
<th>Predilection sites</th>
<th>No. of chickens infested(N = 400)</th>
<th>Prevalence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lice</td>
<td>Menopon gallinae</td>
<td>Fluff/shafts of the feathers of the neck, back, abdomen, wings and areas near cloaca</td>
<td>11</td>
<td>2.75</td>
</tr>
<tr>
<td></td>
<td>Menacanthus stramineus</td>
<td>thigh and breast region</td>
<td>56</td>
<td>14.0</td>
</tr>
<tr>
<td></td>
<td>Lipeurus caponis</td>
<td>Feathers</td>
<td>161</td>
<td>40.25</td>
</tr>
<tr>
<td>Flea</td>
<td>Echidnophaga gallinacea</td>
<td>Comb, wattles, eyelids and around ears</td>
<td>35</td>
<td>8.75</td>
</tr>
<tr>
<td>Ticks</td>
<td>Argaspidius</td>
<td>abdominal area and below wings</td>
<td>18</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>Lipeurus caponis</td>
<td>Shank and toes of legs</td>
<td>28</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>Dermauxys gallinace</td>
<td>wings and Breast</td>
<td>9</td>
<td>2.25</td>
</tr>
<tr>
<td></td>
<td>Cnemidocotes gallinace</td>
<td>Shank and toes of legs</td>
<td>20</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Table 3. Type of Ectoparasites infestation in village chickens (Gallus gallus domesticus) in Potiskum, Yobe State, Nigeria

<table>
<thead>
<tr>
<th>Type of infestation</th>
<th>No. of chickens infested(N= 400)</th>
<th>Prevalence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>36</td>
<td>9.0</td>
</tr>
<tr>
<td>Double</td>
<td>210</td>
<td>52.50</td>
</tr>
<tr>
<td>Multiple</td>
<td>92</td>
<td>23.0</td>
</tr>
<tr>
<td>Total</td>
<td>338</td>
<td>84.50</td>
</tr>
</tbody>
</table>

Note: single infestation = 36/400 (9.0%) while mixed infestation = 302/400 (75.50%)

Table 4. Risk factors associated with ectoparasites infestation in village chickens (Gallus gallus domesticus) in Potiskum, Yobe State, Nigeria

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Risk factors</th>
<th>No. of chickens examined</th>
<th>No. of chickens infested</th>
<th>Prevalence (%)</th>
<th>95% CI LL – UL</th>
<th>p-value</th>
<th>RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Young</td>
<td>142</td>
<td>92</td>
<td>22.75</td>
<td>0.5415 – 0.6704</td>
<td>0.0198</td>
<td>1.185</td>
</tr>
<tr>
<td></td>
<td>Adult</td>
<td>258</td>
<td>246</td>
<td>61.75</td>
<td>0.4672 – 0.5564</td>
<td>0.3481</td>
<td>1.071</td>
</tr>
<tr>
<td>Sex</td>
<td>Females</td>
<td>204</td>
<td>185</td>
<td>46.25</td>
<td>0.4726 – 0.5753</td>
<td>0.0504</td>
<td>1.137</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>196</td>
<td>153</td>
<td>38.25</td>
<td>0.5084 – 0.6146</td>
<td>0.0103</td>
<td>0.9055</td>
</tr>
<tr>
<td>Management</td>
<td>Semi-intensive</td>
<td>116</td>
<td>79</td>
<td>19.75</td>
<td>0.5227 – 0.6649</td>
<td>0.1768</td>
<td>0.9055</td>
</tr>
<tr>
<td></td>
<td>Extensive</td>
<td>284</td>
<td>259</td>
<td>64.75</td>
<td>0.4797 – 0.5278</td>
<td>0.0103</td>
<td>0.9055</td>
</tr>
<tr>
<td>Settlement</td>
<td>Rural</td>
<td>246</td>
<td>225</td>
<td>56.25</td>
<td>0.4758 – 0.5683</td>
<td>0.0362</td>
<td>1.158</td>
</tr>
<tr>
<td></td>
<td>Sub-urban</td>
<td>154</td>
<td>113</td>
<td>28.25</td>
<td>0.5155 – 0.6366</td>
<td>0.0176</td>
<td>0.9055</td>
</tr>
<tr>
<td>Season</td>
<td>Dry</td>
<td>200</td>
<td>142</td>
<td>35.50</td>
<td>0.5304 – 0.6382</td>
<td>0.0103</td>
<td>0.9055</td>
</tr>
<tr>
<td></td>
<td>Rainy</td>
<td>200</td>
<td>196</td>
<td>49.0</td>
<td>0.4552 – 0.5547</td>
<td>0.0176</td>
<td>0.9055</td>
</tr>
</tbody>
</table>

Key: CI= confidence interval; LL= Lower limit; UL= Upper limit; RR= Relative risk *Statistical significance

DISCUSSION

The present study revealed that village chickens in the study area were infested with one or more species of ectoparasites with an overall prevalence rate of 84.5%. This high prevalent rate buttress 95.8% recorded in Kenya (Sabuni et al., 2010), 84.0% in Ghana (Angyiereyiri et al., 2015), 90.77% in Iraq (Abdullah and Mohammed, 2013), 96.0% in South Africa (Moyo et al., 2015), 84.0% in Tanzania (Swai et al., 2010), 86.67% in Bangladesh (Shanta et al., 2006), 83.85% from Ethiopia (Mulugeta et al., 2013) and 88.4% from China (Wang et al., 2010). Moreover, in some parts of Nigeria, several similar studies have recorded varying prevalence rate of 70.5% (Muhammad and Malate, 2014), 69.70% (Oche et al., 2016), 75.85% (Odenu et al., 2016) in Gombe, Benue State and Abuja respectively. Moreover, higher prevalence rate of 100% were recorded in Sokoto (Bala et al., 2011) and Ogun (Ekpo et al., 2010) States of Nigeria. The high prevalence recorded in this present study may be associated with poor sanitation and hygienic practice which creates favorable environment for the propagation and life cycle progression of the diverse
parasitic species, inadequate housing facilities which can create hiding places for the parasite as well as the free ranging management system of village chickens which may expose the chickens to arthropods of several genera. Scavenging nature of the village chickens may possibly expose them to ectoparasites infestations that are origin of other poultry species or wild birds (Adelusi et al., 2014). The difference in the prevalence rates recorded 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 (Bandá, 2011) in the various study areas.

The present study revealed that lice (57.0%) followed by mites (14.25), flea (8.75%) and tick (4.50%) as the common types of ectoparasites that infest village chickens in the study area. The result of this study is in accordance with those of Oche et al. (2016), Lawal et al. (2016) and Kebede et al. (2017) who have reported similar findings from Benue, Gombe States and Ethiopia respectively. However, our finding are in contrast with results of Mungube et al. (2008) and Moyo et al. (2015) who have reported fleas to be most common ectoparasites of free range village chickens in Kenya and South Africa respectively as well as Zeryehun and Yohannes (2015) who have reported mites as the dominant ectoparasites in scavenging village chickens in Ethiopia. The highest prevalent ectoparasites identified in the present study were lice (57.0%) while the least prevalent was tick (4.50%). This finding from this study corroborate those of Agbede (2013), Odenu et al. (2016), Lawal et al. (2016) and Kebede et al. (2017) who have also reported lice to be the most prevalent ectoparasites of free range chickens. However, the lice prevalence rate recorded in the present study was higher than 42.71% reported by Kebede et al. (2017) but lower than 72.72% and 84.30% reported by Sadiq et al. (2003) and Belihu et al. (2010) respectively. The difference in the prevalence rate of lice from the various studies might be attributed to variation in the husbandry and management system, poor hygiene and sanitation, sample size, climatic conditions, humidity, season of study and other agro ecology influencing the distribution and proliferation of lice.

In the present study eight species of ectoparasites were identified at difference predilection sites on the infested chickens which included three species of lice namely, *Lipeurus caponis*, *Menopon gallinae* and *Menacanthus stramineus*; one species of fleanamely, *Echidnophaga gallinaeae*; one species of tick namely, *Argaspermus* and three species of mite namely, *Cnemidocoptes mutans*, *Cnemidocoptes gallinae* and *Dermanyssus gallinae*. The species of ectoparasites recorded in the present study concurs with those reported by Amede et al. (2011) and Kebede et al. (2017) in a similar study. Moreover, the predilection sites of the various species of ectoparasites recorded in this present study are in accordance with those reported by Souls by (1982). Among these species of ectoparasites encountered, *Lipeurus caponis* (40.25%) was the most prevalence while *Dermanyssus gallinae* (2.25%) was the least. The prevalence rate of *Lipeurus caponis* recorded in the present study is comparable with 41.61% reported by Eneanya et al. (2008) form Anambra State, but higher than 18.75% reported by Kebede et al. (2017); 9.26% by Oche et al. (2016); 5.0% by Bala et al. (2011) and 6.20% by Biu et al. (2007). The result of the present study also revealed another species of lice *Menacanthus stramineus* (14.0%) as the second most prevalent species of ectoparasites encountered on the infested village chickens. Although, its prevalence rate was lower than 41.70% reported by Belihu et al. (2010) from Ethiopia but higher than 5.3% recorded by Moyo et al. (2015) from South Africa and 6.9% reported by Bala et al. (2011) from Sokoto State, Nigeria. The prevalence rate of *Menopon gallinae* from the present study was 2.75% which were considered lower than 13.28% reported by Kebede et al. (2017), 8.1% by Bala et al. (2011); 12.4%, 97.7% and 40.12% reported by Moyo et al. (2015), Sabuni et al. (2010) and Sadiq et al. (2003)respectively. These variations in the prevalence rates of these species of lice from the reports of the various studies may be connected to differences in geographical areas, host factors, husbandry and management system, poor sanitation, sample size, period of study as well as different favorable climatic conditions such as Temperature and humidity which may influence the population dynamics of the ectoparasites (Arends, 2003; Prelezov and Kolnarski, 2006).
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

It was observed that most of the village chickens farmers in the study areas keep other livestock, dogs and cats in the same compound with their chickens without maintenance of good sanitations in and around their compound. Although, the prevalence rate 8.75% was recorded in the present study which was considered lower than10.6%, 32.86%, 50.7% and 16.15% recorded by Bala et al. (2011); Alemu et al. (2015); Moyo et al. (2015) and Kebede et al. (2017) respectively. The species of flea (Echidnophaga gallinae) reported in this study have been encountered in scavenging village chickens from many parts of the world including Nigeria (Ifeoma et al., 2008; Bala et al., 2011; Oche et al., 2016; Lawal et al., 2016) and some parts of Africa (Permin et al., 2002; Maina, 2005; Mungube et al., 2008; Kebede et al., 2017) at varying prevalence rates. In many cases the occurrences of this species of flea in chickens have been attributed to keeping dogs and cats with chickens under poor housing and hygiene especially where the pets share accommodation with chickens (Moyo et al., 2015). E. gallinae has been reported to infest different hosts including different breed of chicken, other species of domestic poultry, wild birds, humans, mice, cats and dogs (Mungube et al., 2008). The prevalence rate of this flea species is widespread in tropical and subtropical regions (Permin et al., 2002). The variation in prevalence rates may be associated with difference in geographical and climatic factors, inadequate husbandry and management system.

Argas persicus was the only tick species record in this study at a prevalence rate of 4.50%. This finding is comparable to 4.97% and 4.71% reported by Mulugeta et al. (2013) and Oche et al. (2016) from Ethiopia and Benue State Nigeria respectively, but higher than 3.30% recorded by Zeryehun and Yohannes (2015) from Ethiopia, however lowers than8.80%, 30.0%; 19.0% and 62.72% reported by Bala et al. (2011),Dubeet al. (2010), Mirzaei et al. (2016) and Abdullah and Mohammed (2013) from Sokoto, Nigeria, Zimbabwe, Iran and Iraq respectively. The difference may be associated with different agro-ecology, climatic factors in the various study areas, variation in sample size and differences in sampling period, free range nature of village chickens, poor hygiene in and around the chicken house and the lack of parasite control practices.

Three species of mite namely Cnemidocoptes mutans, Cnemidocoptes gallinae and Dermanyssus gallinae were reported in this study with C. mutans as the most prevalent mite. This finding concurs with the findings of Shanta et al. (2006), Taylor et al.(2007); Swai et al.(2010); Oche et al. (2016) who have mentioned this species of mites as the predominant species causing scaly leg on most mite infested village chickens in their various studies. Although, the prevalent rate of C. mutans (7.0%) recorded in our study is comparable to 7.26% and 9.40% reported by Odenu et al. (2016) and Bala et al. (2011) respectively, but higher than 0.57% reported by Moyo et al. (2015) and lower than 34.62% and 18.18% recorded by Firaol et al. (2014) and Oche et al.(2016) respectively. The prevalence of Cnemidocoptes gallinae (5.0%) recorded in our study was considered lower than 8.1% reported by Bala et al. (2011). The prevalence of Dermanyssus gallinae (2.25%) reported in our study is considered lower than 7.03% reported by Kebede et al. (2017) from Ethiopia. It was speculated 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, varied season of sampling, sample size and the study location with respect to urban or rural settlements.

The result of our study reveal that affected village chickens were found to harbor one or more ectoparasites species; 9.0%, 52.50% and 23.0% of the ectoparasites infestation occur in single (infested by only one species of parasite), double (infested by two species of parasites) and multiple (infested by more than two species of parasite) respectively. The mixed ectoparasites infestation of village chickens found in this study is consistent with previous report by Amede et al. (2011), Mulugeta et al. (2013) and Firaol et al. (2014) in Ethiopia. The prevalence rate of mixed ectoparasites infestation in the present study area may be associated with the poor husbandry and management system, agro-ecology and climatic factors and whether or not strategic ectoparasites control measures were adopted in the study area.

The present study revealed a significant difference in the prevalence of ectoparasites infestation in village chickens when age was considered as one of the hypothesized risk factors. The findings revealed that adult (61.75%) village chickens are significantly more infested by ectoparasites than young (22.75%) chickens. This buttress similar report by Biu et al. (2007),...
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

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 ectoparasites compared with younger ones. The high prevalence rate of ectoparasites in adult chickens compared to the young ones might possibly be associated with the fact that adult chickens scavenge through a wider area mingling with other species of poultry or animals and maybe exposed longer to the infested environment and other source of infestation than the young chickens, hence a higher prevalence rate. 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 ectoparasites compared to the adult chickens.

The result of the present study revealed that the female (46.25%) village chickens are more infested than the male (38.25%) ones, although the difference was not significant. This non-significant variation between the sexes signifies that the hens and cockerels of village chickens share equal chance of getting ectoparasites infestation especially where both sexes are reared in the same pen, allowed to mate with each other, when exposed to the same species of ectoparasites fauna and conditions that favors ectoparasites proliferation such as inadequate husbandry system, overcrowding and poor sanitation. Moreover, the high prevalence of ectoparasites in the female village chickens may be associated with the stationary state of the females during incubation of eggs which allows the female chickens to be more susceptible to ectoparasites infestations if the pen is harboring the ectoparasites 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 ectoparasites 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 rate of avian ectoparasites.

The result of the present study revealed that the village chickens reared under the extensive management systems (64.75%) are more infested by ectoparasites than those reared under the semi-intensive management system (19.75%). This finding is consistent with similar work of Mekuria and Gezahegn (2010); Malann et al. (2016) and Kebede et al. (2017). This finding may be connected to better measures and practices related to good housing, proper sanitation, feeding and husbandry system applied in semi-intensive compared to complete extensive system. Although the difference in our finding was not significance which signifies that infestation by ectoparasites may occur in both management systems where the proper control measures are not put in place. The high prevalence rate of ectoparasites fauna recorded in extensive management system could be associated to the free-range rearing system of village chickens practiced in the study area, which exposes the chicken to poor hygiene thus, enabling them to come in contact with a wide range of ectoparasites. Moreover, Mungube et al. (2008) have reported than the free-range scavenging system provides a more sustainable environment for the parasites coupled with lack of inadequate control measures towards these parasites.

The result of the present study also revealed that the village chickens sampled from the rural settlements (56.25%) of the study area are found to be more infested by ectoparasites than those sampled from the semi-urban areas (28.25%) of the study area. This finding may be associated with that fact that most village chickens in the rural areas of the study area are usually reared under traditional extensive management system where the chickens are allowed to scavenge for food and are provided with inadequate husbandry and left without veterinary health care. In most instances it was observed that village chicken farmers in the rural settlements of the study area rear their chickens with other poultry species, livestock and animals within the same compound. These types of practice make the village chickens in these rural areas more vulnerable and get infested easily by ectoparasites. This finding is in agreement with those of Nnadi and George, (2010) and Mulugeta et al. (2013) who have also reported that majority of the village chickens reared in the rural areas are usually reared under free range scavenging system which exposes them easily to infections by several pathogens and parasitism including the external parasites infestation.

The result of the present study revealed that the ectoparasites infestation was statistical
Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria

significantly higher during the rainy season (49.0%) compared to the dry season (35.50%). This finding is in line with those of Mohammad et al. (2016) who also reported high prevalence of ectoparasites in chickens during the rainy season. The rainy season is considered the most favorable weather for the proliferation of parasitic infections including the ectoparasites. Moderated to high ambient temperature and humidity which are one of the characteristics of the rainy season are very essential for the hatching of eggs and larval developmental stages (Soulsby, 1982). This justifies the report that external parasites of poultry are common in the tropics because of the favorable climatic conditions for their development (Nnadi and George, 2010; Firaol et al., 2014). Although, the prevalence of ectoparasites have also been reported during the dry season by other researches, but it was justified that prevalence rate are usually high during the rainy seasons compared to the dry season (Alemu et al., 2015; Kebede et al., 2017).

CONCLUSION

It can be concluded that lice, fleas, tick and mites are the common types of ectoparasites infesting the village chickens population in Potiskum, Yobe State. Among the ectoparasites identified, the lice are the most predominant. The overall prevalence rate of lice infestation (57.0%) was higher than that of mite (14.25%), flea (8.75%) and tick (4.5%) in all the infested chickens. Mixed infestation of ectoparasites was more common than the single infestation. The different species of ectoparasites identified in this study provide evidence of the existence of diverse ectoparasites fauna in the present study locations. Taking into consideration the life cycle of the parasites and their direct and indirect effects on the affected chickens, the mixed infestation will obviously affects the performance and productivity of the chickens. Among the potential risk factors assessed in the present study, ectoparasites infestations was higher among the adult age group of chickens, females, chickens reared under the extensive management systems, chickens reared in rural areas and chickens sampled during the rainy season of the study period. Finally, the observed results of the present study suggest that appropriate ectoparasites control measures should be practiced in village chickens production system to curb the effect of ectoparasites infestations. Village chicken farmers should be enlightened on the economic importance of ectoparasites on the village chicken production and be encouraged to improved husbandry and management system as well as sanitation in and around their poultry houses.

ACKNOWLEDGMENTS

The authors wish to thank all the technical staff of the Department Veterinary Parasitology and Entomology Research Laboratory, University of Maiduguri for their technical assistance throughout the course of this research.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria


Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria


Ectoparasites infestation and its Associated Risk Factors in Village Chickens (Gallus gallus domesticus) in and Around Potiskum, Yobe State, Nigeria


