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Research Paper

Prevalence and Economic Significance of Ectoparasites Infestation in Village Chickens (*Gallus gallus domesticus*) in Gombe, Northeastern Nigeria

J. R. Lawal[1*], A. M. Bello[1], S. Y. Balami[2], Y. Wakil[1], Z. B. Yusuf[3], J. Dauda[4], E. S. Mshelia[1], H. P. Mana[2], M. K. Adam[3] and A. A. Biu[5]

[1]Department of Veterinary Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.
[2]Poultry Unit, Veterinary Teaching Hospital, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.
[3]Department of Veterinary Surgery and Theriogenology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.
[4]Department of Veterinary Public Health and Preventive Medicine, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.
[5]Department of Veterinary Microbiology and Parasitology, Faculty of Veterinary Medicine, University of Maiduguri, Maiduguri, Borno State, Nigeria.
*Corresponding author E-mail: rabanajallailudeen@yahoo.com

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A cross sectional study was conducted from August 2014 to January 2015 to identify 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. Ten different species of ectoparasites, namely *Menopon gallinae, Lipeurus caponis, Goniodes gigas, Cnemidocoptes mutans, Dermanyssus gallinae, Epidermoptes species, Laminosioptes cysticola, Megninia species*, *Echidnophaga gallinacean* and *Argas persicus* were identified in the study. *Menopon gallinae* (50%) was most frequently encountered while *Megninia species* (2.7%) was least prevalent. 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.

Key words: Prevalence, Ectoparasites Infestation, Economic significance, Gombe, Northeastern Nigeria,Village chicken.

INTRODUCTION

Village poultry production is an integral part of a balanced farming system; it has a unique position in the rural household economy supplying high quality protein to the family (Alders and Spradbrow 2001; Copland and Alders, 2005; Alders *et al*., 2009; Angyiereyiri *et al*., 2015). It also serves as a source of easily disposable petty income for the rural dwellers (Alders *et al*., 2009). They require little labor intensity, affordable inputs and low initial investment compared to other livestock production activities (Alders and Spradbrow, 2001; Alders, 2004). It is also reported that village poultry play a significant role through their contribution to the cultural and social life of rural dwellers (Alders, 2004; Copland and Alders, 2005; Mwale and Masika, 2009). Among the village poultry species, village chicken in Nigeria represents a significant part of the national economy in general and the rural economy in particular (Lawal *et al*., 2015). Unfortunately, the majority of these chickens are maintained under traditional system with little or no inputs for housing, feeding or veterinary health care (Geidam *et al*., 2011; Hagos and Eshetu, 2005; Belihu *et al*., 2010; Bala *et al*., 2011). These birds can easily be exposed to harsh environmental conditions or be infected with several types of diseases of bacterial, viral, fungal and parasitic pathogens (Mungube *et al*., 2006; Musa *et al*., 2008; Nyoni and Masika, 2012; Lawal *et al*., 2015). Among various parasitic diseases, ectoparasites infestations are of great economic importance in village chicken production systems (Belihu *et al.,* 2010; Natala *et al*., 2009; Nnadi and George, 2010; Firaol *et al*., 2014). They usually consume dead cells of the skin and tissue fluids, cause heavy morbidity by sucking blood, while other causes irritation to the birds, which adversely affects their economical productivity (Mullen and Durden, 2002; Permin *et al*., 2002; Mungube *et al*., 2006; and Nyoni and Masika, 2012).

Ectoparasitism has been identified as one of the major factors that threaten scavenging village chicken production systems in developing countries (Zumani, 2011). Reports have shown that mortality due to parasitic diseases is higher than those attributed to some poultry viral infectious diseases such Newcastle disease and fowl pox disease (Nnadi and George, 2010; Opara *et al*., 2014). Common ectoparasites of village chickens range from lice, mites, fleas and ticks (Nnadi and George, 2010). They may constitute a clinical problem and transmit a number of infectious diseases and can also act as transport/ intermediate hosts of a range of helminth parasites (Arends 2003; Marques *et al*., 2007; Firaol *et al*., 2014). Some of the ectoparasites, especially tick and mites acts as vectors of poultry diseases such as Pastuerellosis, Fowl Pox, Newcastle disease and possibly chlamydia (Nnadi and George 2010; Moyo *et al.,* 2015). Parasitic infection or their concurrent infections has been known to result in immunosuppression, especially in response to vaccines against some poultry diseases (Horning *et al.,* 2003; Nnadi and George, 2010). These parasites are common in rural settlements that usually practices extensive poultry husbandry systems where in most cases there is inappropriate housing and lack of appreciable pest control efforts (Mungube *et al.,* 2006), whereas these facilities are usually provided in commercial exotic poultry production systems. High losses of village chickens due to diseases pose a serious threat to food security and livelihood of many rural families (Musa *et al*., 2008). It is believed that understanding the nature of parasitic diseases of birds will assist in devising the appropriate measures to improve the health and utility of these birds (Msoffe *et al*., 2010; Amede *et al*., 2011).

Ectoparasites may be a considerable constraint to Nigerians efforts to achieve increased production of village chickens and chicken products to enhance food security, alleviation of poverty and improvement of job creation among youth so as to meet the demand of the fast growing populace of the country. Information available on the distribution of ectoparasites in village chickens in some parts of Nigeria are those of Bunza *et al.* (2008), Bala *et al.* (2011) and Usman *et al*. (2012) in Sokoto State northwestern Nigeria, George *et al*. (2004) in Zaria North Western Nigeria, Ekpo *et al*. (2010) in Abeokuta Ogun State, Audi and Asmau, (2014) in Kano State, Sadiq *et al*. (2003) in Ibadan, Eneanya *et al.* (2008) in Akwa – Anambra and Biu *et al.* (2007; 2012) in Maiduguri North Eastern Nigeria.

At present, no routine government policy and activity is in place for routine control and prevention of village chicken ectoparasitism in Nigeria. Adequate control practice of ectoparasites in rural areas is not carried out. Research on ectoparasitism of livestock has mostly been concentrated on ticks and biting flies in ruminants (Cattle, sheep and goats) because of economic significance of ectoparasite borne diseases (Omudu and Amuta, 2007; Onojafe, 2008; Ohaeri and Ugwu, 2013; Obi *et al*., 2014; Adang *et al*., 2015).

However, no studies were conducted on village chickens ectoparasites in Gombe, Northeastern Nigeria, where the village chickens serves as source of petty income generation and food. Thus, the current study was undertaken to determine the prevalence of ectoparasites in village chickens, identifies species of ectoparasites infesting village chickens and evaluate the economic significance of ectoparasites infestation in Gombe, Northeastern Nigeria.

MATERIALS AND METHODS

Study area

The study was carried out within Gombe metropolis. Gombe township lies between Latitude 10°08^{1}N and 11º24^{1} E and longitude 11º 02^{1} N and 11º 18^{1}E of the

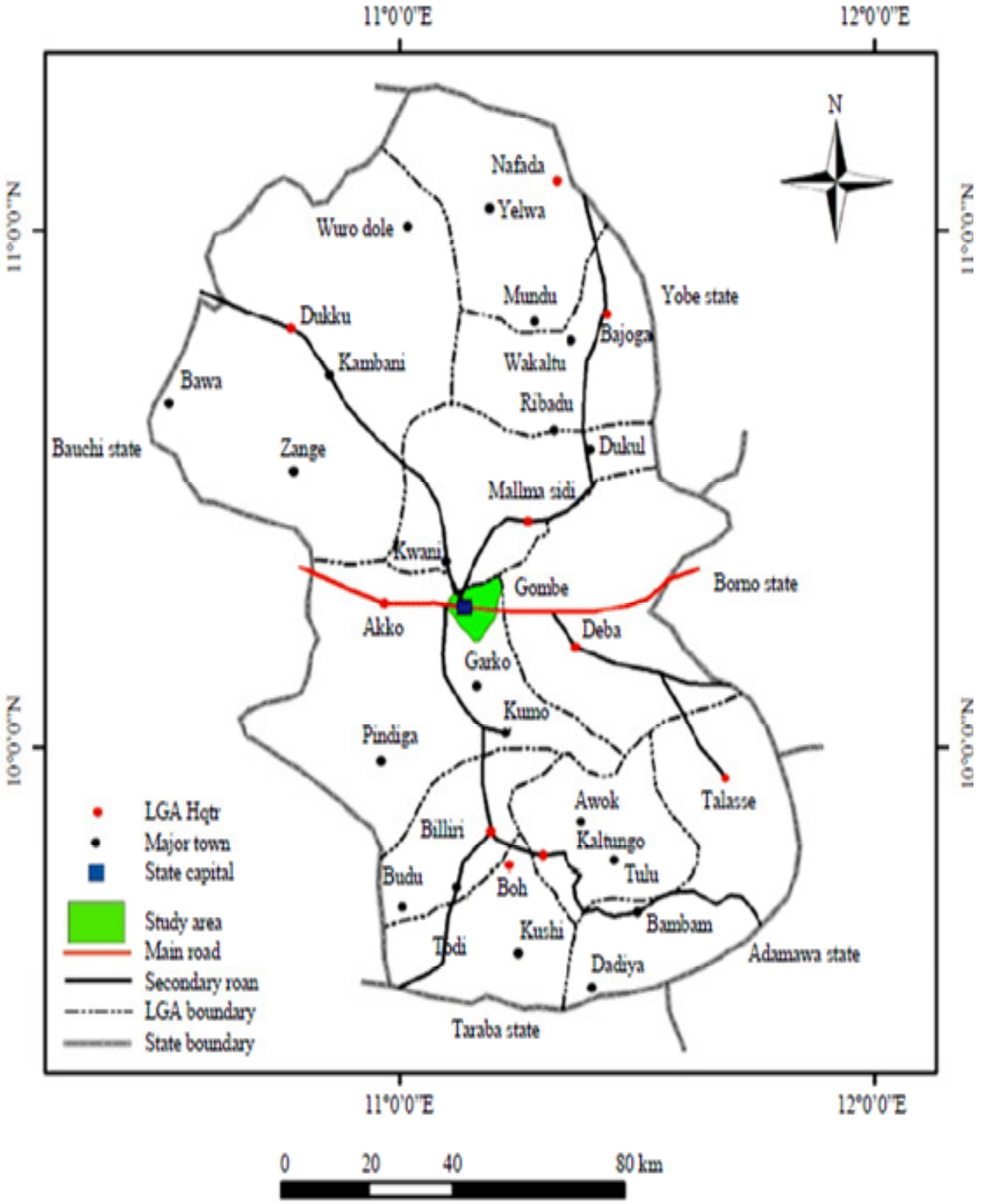

Figure 1. Map of Gombe State showing the study area in green.

Greenwich Meridian (Figure 1). The size of the town is 20,265 km^2, with a population of about 200,000 inhabitants. Gombe town is between 400-450 feet, above sea level. The occupation of most of the inhabitants is agriculture which includes village poultry, cattle, sheep and goat rearing under the extensive and semi-intensive

Table 1. Prevalence of ectoparasites in village chickens in Gombe metropolis, Gombe, Nigeria.

Study location	Number of chickens examined n= 1025	Number of chickens affected	Relative Prevalence (%)
Jakadafari	96	91	94.8
Bolari	105	93	88.6
Harwagana	101	95	94.1
Tudunwada	99	89	89.9
Pantami	114	106	93.0
State Lowcost	96	83	86.5
GRA	89	72	80.9
Gabukka	108	105	97.2
AngwanDawaki/ Ajiya	117	107	91.5
MallamKuri	100	89	89.0
Total	1025	930	90.7

animal husbandry management systems. The annual rainfall ranges between 850-1000 mm, with two distinct seasons. The rainy season which starts from May to October and dry season, from November-April. Average daily temperatures are 34ºC in April and 27ºC in August. The relative humidity ranges from 70-80% in August and decreases to about 15-20% in December. The natural vegetation is typically that of the Sudano-Sahelian Savannah, which is composed of shrubs, herbs, grasses and sparsely distributed trees. Cereals such as ground nut, maize, guinea corn, millet and cowpea are predominantly grown in the area and provide enough fodder for the animals (Anonymous, 2003).

Sampling procedure

One thousand and twenty five village chickens which comprises of both sexes and various ages were sampled from localities within the Gombe metropolis. Household with moderately large numbers of village chickens population and that are willing to voluntarily cooperate with the sampling procedures were randomly selected and included in the study, while some of the selected farmers were tipped with incentives before allowing the use of their birds for the sampling procedures of ectoparasites infestations. Sampling was carried out for a period of six months on weekly basis. Ectoparasites were collected from the body/skin of each bird and not from the ground in order to minimize accidental collections of other arthropods that do not actually parasitize birds. Examination for ectoparasitic infestations was carried out early in the morning and in the evening.

Parasitological procedures

Investigation for ectoparasites infestation in birds was performed by carefully parting feathers horizontally against the anatomical direction of alignment so as to expose parasites and allow visual inspection of the skin and other parts of the birds' body (Yacob *et al.,* 2009). Ectoparasites were collected from the body of the birds using the forceps-picking and feather-brushing methods described by Angyiereyiri *et al.* (2015). The entire body of the bird was thoroughly inspected and gently brushed with a fine soft brush; special attention was paid to under the wings as recommended by Angyiereyiri *et al*. (2015). In the case of strong attachment and embedded ticks, the ticks were removed using chloroform by dabbing the ticks and the skin. Lice, fleas and mites were collected by dipping a brush in ethanol before combing and brushing the feather/skin of the bird onto a white blotting paper (Wall and Shearer, 2001). The parasites collected were preserved in 70% ethanol in well labeled glass vials and other data were recorded accordingly.

Ectoparasite identification

Ticks, lice, fleas and mites were identified according to keys and descriptions by Soulsby, (1982), Arends, (2003), Walker *et al.* (2003), Ruedisueli and Manship, (2006). Ticks were examined under the light microscope and each morphological character was measured and recorded for identification. Lice, fleas and mites were heated in 5% KOH for 20 min, washed and dehydrated by treating them with ethanol, then cleared in xylene for 20 min and mounted on the light microscope. Identification was confirmed by the technical staff of the Veterinary Area Office, Gombe, Gombe State, Nigeria.

Data analysis

Data obtained for ectoparasites were analyzed using simple descriptive statistics. Data were analyzed using simple percentage to express the prevalent rate and frequencies of ectoparasite infestation.

RESULTS

Table 1 shows the results of the prevalence ectoparasites

Table 2. Ectoparasites encountered according to parasitic infestation (single or mixed infestations) in Gombe, Nigeria.

Parasitic infestation	Type of ectoparasite encountered	Number of chickens affected (y)	Relative Prevalence (%) (y/1025) x 100
Single infestation	Lice	136	13.3
	Fleas	12	1.2
	Mites	17	1.7
	Ticks	8	0.8
Mixed infestation	Lice and Fleas	52	5.1
	Lice and Mites	461	45.0
	Fleas and Mites	14	1.4
	Lice, Fleas and Mites	174	17.0
	Lice, Mites and Ticks	28	2.7
	Lice, Fleas, Ticks and Mites	28	2.7
Total		930	90.7

Single ectoparasites infestation sum up into 17.0% while the mixed ectoparasitic infestation sum up into 73.9% of the total prevalent rate in the study areas.

Table 3. Prevalence of different species of ectoparasites according to the infested anatomic site on village chickens in Gombe, Nigeria.

Type of ectoparasites	Species of Ectoparasite encountered	Predilection site	Total Number of birds affected (y)	Relative Prevalence (%) (y/1025) x 100
Lice	*Menopon gallinae*	Feather shafts and all over the body	513	50.0
	Lipeurus caponis	Under the large wing feathers	227	22.1
	Goniodes gigas	Within body feathers	139	13.6
Mites	*Cnemidocoptes mutans*	Lower limbs (non-feathered areas)	347	33.9
	Dermanyssus gallinae	Entire body	142	13.9
	Epidermoptes species	On the body	173	16.9
	Laminosioptes cysticola	On subcutaneous tissue	32	3.1
	Megninia species	On feathers (quills)	28	2.7
Flea	*Echidnophaga gallinacean*	Around the Comb, wattles, eyes and ears	280	27.3
Tick	*Argas persicus*	Ventral abdominal area and beneath the wings	64	6.2

infestation in Gombe metropolis according to study location. Out of the ten different study location visited for village chicken examination in Gombe, the following prevalent rates were encountered in descending order: Gabukka (97.2%), Jakadafari (94.8%), Harwagana (94.1%), Pantami (93.0%), AngwanDawaki/Ajiya (91.5%), MallamKuri (89.0%), Tudunwada (89.9%), Bolari (88.6%), State Lowcost (86.5%), GRA (80.9%).

Table 2 shows the results of the ectoparasites infestation in Gombe, Nigeria. Out of the total one thousand and twenty five village chickens examined, nine hundred and thirty (90.7%) were infected with one or more types of ectoparasites, namely; lice, fleas, mites and ticks. In single infestation, 33.3% birds had lice, 1.2% fleas, 1.7% mites and 0.8% had ticks. Of the 930 infested birds, 17.0% had single, while 73.9% had mixed infestations. Mixed infestations of ectoparasites was encountered as follows: lice and fleas (5.1%); lice and mites (45.0%), fleas and mites (1.4%); Lice, Fleas and Mites (17.0%), Lice, Mites and Ticks (2.7%), Lice, Fleas, Ticks and Mites (2.7%). Table 3 shows the results of the prevalence of different species of ectoparasites according to the infested anatomic site on village chickens in Gombe, Nigeria. Lice (85.8%) were the most prevalent ectoparasite encountered, while mites (70.4%), flea (27.3%) and ticks (6.2%) were also encountered in this study. In species specific prevalence, the prevalent rates encountered was as follows in descending order: *Menopon gallinae* (50.0%) which were seen on the feather shafts and all over the body of examined birds, *Cnemidocoptes mutans* (33.9%) found around the lower limbs (non-feathered areas), *Echidnophaga gallinacean* (27.3%) around the Comb, wattles, eyes and ears, *Lipeurus caponis*(22.1%) found under the large wing feathers, *Epidermoptes species* (16.9%) found on some parts of the body. *Dermanyssus gallinae* (13.9%)

found on entire body, *Goniodes gigas*(13.6%) found within body feathers, *Argas persicus* (6.2%) found around the ventral abdominal area and beneath the wings, *Laminosioptes cysticola* (3.1%) on subcutaneous tissue and *Megninia species* (2.7%) found on the on feathers (quills).

DISCUSSION

The present study revealed the occurrence of various species of ectoparasites within different external anatomical parts of village chickens following thorough body examination of each randomly sampled bird. It has been established that ectoprasites are important constraints to village chickens production system. This study have revealed varying prevalent rate of ectoparasitism in village chickens with higher prevalent rates of 97.2%, 94.8% and 94.1% encountered in Gabukka, Jakadafari and Harwagana areas respectively while 86.5% and 80.9% prevalent rates were found in Gombe State Lowcost quarters and Government Residential Area (GRA) respectively. Four types of ectoparasites genera were encountered in this present study in all the study areas. The prevalence of ectoparasites infestation encountered in village chicken production system in this study were 85.8% lice, 70.4% mite, 27.3% flea and 6.2% tick of different species. This finding is consistent with the finding of Sabuni *et al.* (2010).

Ectoparasites were found on different body parts of the examined chickens. Wherever part of the birds' body ectoparasites infest, they cause lot of irritations by their biting and sucking activities. This may distracts the birds from its normal activities such as feeding, incubation of eggs and such parasites also serves as transmitters of blood parasitic diseases (Wall and Shearer, 2001; Shanta *et al*., 2006; Hobbenaghi *et al*., 2012). The observed overall prevalence rate of ectoparasites (90.7%) in village chickens from the study areas was considerably high, which indicated that ectoparasite infestation is a common problem among this class of poultry in the study areas. This high prevalence of ectoparasitism may be associated with the provision of poor housing facilities (Figure 2) for village chickens in some of the study areas, which creates conducive environment for the breeding of the diverse parasitic arthropods. It have been well established that ectoparasitic infestation has direct or indirect effects on the productivity of village chickens in developing countries of Africa such as Tanzania (Swai *et al*., 2009); Ethiopia (Belihu *et al*., 2010; Mekuria and Gezahegn, 2010; Tolossa and Tafesse, 2013); Kenya (Mungube *et al*., 2008; Sabuni *et al.,* 2010); Ghana (Angyiereyiri *et al*., 2015); Zimbabwe (Permin *et al*., 2002; Mukaratirwa and Hove, 2009); Malawi (Njunga, 2003; Zumani, 2011); Nigeria (Sadiq *et al*., 2003; Biu *et al*., 2007; Natala *et al*., 2009; Nnadi and George, 2010; Ekpo *et al*., 2010; Bala *et al*., 2011; Biu *et al*., 2012). However, varying high prevalence rate of 91.5% (Belihu *et al*., 2010), 86.67% (Shanta *et al*., 2006), 83.85% (Mulugeta *et al*., 2013) and 100% (Ekpo *et al*., 2010; Bala *et al*., 2011) have been reported in different study. The difference between our findings and that of the other previous researches may be due to breed or ecotypes of birds, seasonality of infection, management / husbandry systems, agroecological, and implemented methods of the parasitic control (Mungube *et al.,* 2008; Mekuria and Gezahegn, 2010; Bala *et al*., 2011). Our study was conducted during rainy season towards early dry season of the year (August to January) while others might have conducted ectoparasites samples collection during the dry season of the year (Belihu *et al*., 2010) or during heavy rainy season (Firaol *et al.,* 2014).

Ectoparasites infected chickens in the present study were found to harbor single or mixed infestation of ectoparasite species. 17.0% of the total examined chickens were found to be infested with single species of ectoparasites while 73.9% were infested with mixed ectoparasitic infestation. The mixed ectoparasitic infestation of chickens found in this study was lower than 81% ectoparasitic infestation reported by Al-Saffar and Al-Mawla (2008) in Iran but higher than 48.21% reported by Firaol *et al.* (2014) and 67.4% reported by Amede *et al.* (2011) in Ethiopia. However, the single infestation of 19% reported by Al-Saffar and Al-Mawla (2008) was slightly higher than that of our findings. The observed variation in the proportion of single and mixed infestation in village chickens would be related to difference of implementation of management system and whether or not strategic ectoparasitic control measures were adopted in the various study areas.

In our study, lice infestation (85.8%) was the most prevalent followed by mite (70.4%), Flea (27.3%) while tick infestation (6.2%) was the least prevalent ectoparasites. The finding of this current study is consistent with report of Mekuria and Gezahegn (2010) from Ethiopia and Sabuni *et al*. (2006) from Kenya in which 88% and 90% of lice was reported respectively. These findings may be related to favourable climatic condition for the successful breeding and development of the parasites in the study areas (Hopla *et al*., 1994).

Ten species of ectoparasites, namely *Menopon gallinae, Lipeurus caponis, Goniodes gigas* (Lice)*; Cnemidocoptes mutans, Dermanyssus gallinae, Epidermoptes species, Laminosioptes cysticola, Megninia species* (Mites)*; Echidnophaga gallinacean* (Flea) and *Argas persicus* (Tick) were identified in the present study. This finds is consistent with those of Bala *et al*. (2011) and Mukaratirwa and Hove (2009) that reported ten and eleven different ectoparasites respectively in village chickens during a similar study. However, most of these species were also reported from different parts of the African countries such as Zimbabwe (Mukaratirwa and Hove,2009), Ehiopia (Mulugeta *et al*., 2013),

Figure 2. A typical village chicken housing system in some rural areas within Gombe, Nigeria.

Malawi (Zumani, 2011), South Africa (Mukaratiwa and Khumalo, 2012; Moyo *et al*., 2015) including Nigeria (Ikpeze *et al*., 2008, Ifeoma *et al*., 2008; Bala *et al*., 2011, Usman *et al*., 2012). This indicates widespread of these ectoparasite species in village chickens in most of the African countries including Nigeria. Although variations in the findings might be due to the numbers of birds examined, type of management system practice, climatic and geographic (altitudinal) difference among the various study areas. Among the identified ectoparasite species found on the examined village chickens*, Menopon gallinae* was most frequently identified (50%) species while *Megninia species* (2.7%) was the least encountered ectoparasite species. The dominance of *Menopon gallinae* over other species of lice was also previous reported by Sabuni *et al.* (2010), Deepali *et al*. (2005) and Ilyes *et al.* (2013). This was attributed to high humidity in their study areas which favours the breeding of the parasites. However, the prevalent rate of *Menopon gallinae* encountered in this study is consistent with the finding of Saxena *et al*. (2004) and Radfar *et al*. (2012) who reported close rate of 51.3% and 55.93% respectively. Our findings is lower than 97.7% and 83.18% reported by Sabuni *et al*. (2010) and Ilyes *et al.* (2013) respectively, but higher than 44.95% reported by Mulugeta *et al.* (2013); 47.4% (Mukaratirwa and Hove, 2009), 34.0% (Zumani, 2011), 8.1% (Bala *et al*., 2011) and 14.8% (Amede *et al*., 2011). The prevalence of 22.1% of *Lipeurus caponis* encountered in this studyis higher than 5% reported by Bala *et al.* (2011) and 0.67% report of Belihu *et al.* (2010), but lower than 32% and 48% reported by Eslami *et al.* (2009) and Shanta *et al.* (2006) respectively. Prevalence of *Goniodes gigas* (13.6%) is slightly lower than 14.5% reported by Audi and Asmau (2014) but higher than 6.5% reported by Moyo *et al.* (2015) who carried out similar study. *Cnemidocoptes mutans* (33.9%) encountered in this study is in line with 34.5% reported by Firaol *et al*. (2014). *Dermanyssus gallinae* (13.9%) encountered in this study was lower than 71.2% and 10.1% reported by Zumani (2011) and Moyo *et al.* (2015). *Epidermoptes species* (16.9%) encountered in this study is lower than the finding of Sabuni *et al.* (2010) who reported 83.2% prevalence of the parasite in village chickens in their study area. The finding of *Laminosioptes cysticola* (3.1%) encountered in this study is higher than 0.4% reported by Mukaratirwa and Hove (2009). *Megninia species* (2.7%) encountered in this study have rarely been reported in village chickens in Nigeria but have been reported in Kenya by Sabuni *et al.* (2010).

The finding of ectoparasites of unique species in village chickens population may possibly occur where this class

of birds is reared within the same environments or enclosures with other livestock species (cattle, sheep, goats, rabbits) (Asadollahi *et al*., 2014; Adang *et al*., 2015), companion animals (cats, dogs) (Karshima *et al*., 2010; Shitta *et al*., 2011; Adamu *et al*., 2012), wild domesticated birds (Ostriches, doves, peacocks or parrots) or other domestic birds species (guinea fowl, turkeys, ducks or pigeon) especially where these animals are reared under unhygienic husbandry systems (Ekpo *et al*., 2010; Radfar *et al*., 2012; Audi and Asmau, 2014; Al-Mayali and Abdul-Kadhim, 2015; Angyiereyiri *et al*., 2015). Prevalence of *Echidnophaga gallinacean* (27.3%) encountered in this study is lower than 50.7%; 71.9%; 44.4% and 51.16% reported by Moyo *et al.* (2015), Mukaratirwa and Hove (2009), Firaol *et al.* (2014) and Belihu *et al.* (2010) respectively, but higher than 9.4% and 0.89% reported by Bala *et al*. (2011) and Biu *et al.* (2012). *Argas persicus* (6.2%) was the only tick species of birds encountered in this study. This finding was consistent with the findings of Bala *et al.* (2011), Mulugeta *et al*. (2013) and Mukaratirwa and Hove (2009) who recorded 8.8%, 4.97% and 5.2% respectively in a similar study. However, Bunza *et al.* (2008) reported 62.2% prevalence of *Argas persicus* in village chickens in a survey to study the ticks in domesticated birds. Considering the respective findings reported in the various works, the difference might be due to the numbers of birds examined during various study, type of management system practice, climatic and geographic (altitudinal) difference among the various study areas.

Conclusion

Village poultry production has formed an integral part of livestock production systems in most developing countries including Nigeria. They serves as source of petty cash and high quality protein derived respectively from sales and consumption of poultry products (meat and eggs), yet this potential lucrative enterprise is still the most neglected in terms of management, husbandry practice and particularly veterinary health care, especially in rural communities where majority of the village chickens are reared. Generally, the finding of the present study clearly indicated that ectoparasites infestations are highly prevalent in scavenging village chickens production and management system which is associated with inadequate hygienic system, poor husbandry / management, lack of Strategic ectoparasites control practices. In most villages chicken production system, the economic importance of ectoparasites and the havoc caused by heavy infestation are generally overlooked by farmers. This may be reflected by low productivity and increased loss of the birds especially during period favourable to breeding of the parasites. Poor housing facilities can create hiding places for the parasite and this may jeopardize effort made toward control and treatment. It is assumed that arthropods in poultry houses can generate continuous infestation even following treatment of environment using insecticides.

Recommendations

In order to improve village chicken production in Gombe, there should be provision of modern veterinary health centers and competent veterinarians to manage poultry diseases especially diseases caused by menace of ectoparasitic infestation, this might reduce higher distribution and persistence of ectoparasites in birds. Farmers should be educated on the economic importance of ectoparasites infestation in their village chicken flocks and also be trained on how to carry out the strategic control measures.The role of the State Veterinary Services (and veterinarians) is of paramount importance to assist village chicken farmers in using the correct control products and dosing to avoid building even further acaricide resistance. Knowledge transfer between veterinarians, scientists and the farming communities would also avoid misusing control methods which on a long term will bring more problems to the poultry industry.

AUTHORS` DECLARATION

We declare that this study is an original research by our research team and we agree to publish it in the journal.

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