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Study on the Prevalence of Ectoparasitic Arthropods on Free Range *Gallus domesticus* in Two Communities in Awka

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Authors' contributions

This work was carried out in collaboration among all authors. Authors CCN and CJG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors PCOI and CCN managed the analyses of the study. Author CJG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

A survey was carried out to determine the prevalence of ectoparasitic arthropods in free range domestic fowl *(Gallus domesticus)* in Amansea and Ifite communities, in Awka Capital Territory, Anambra state. A total of 112 *G. domesticus* comprising of 42 Adult males, 30 adult females and 40 juveniles were examined during a house to house survey for ectoparasitic arthropods. The study was carried out between June and September, 2014. The domestic fowl were caught in their roosting places at night and were examined for ectoparasitic arthropod infestation. 73.21% prevalence of ectoparasitic arthropods on the chicken was recorded. Male adult chicken had higher prevalence of ectoparasitic arthropods than adult females and juvenile chicken. Six species of ectoparasitic arthropods namely; *Argas persicus* (29.46%), *Menopon gallinae* (23.21%), *Dermanysus gallinae (*16.07%), *Lipeurus caponis* (12.5%), *Echidnophaga gallinacea* (10.71%) *Goniocotes gallinae* (5.36%) were recovered from infested chicken. *Argas persicus* with the

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prevalence (29.46%) was the most prevalent parasite species. Amansea community had a higher prevalence of ectoparasitic arthropods than Ifite community. The difference was statistically significant (P<0.05). In conclusion, the present study has provided information on the various ectoparasitic arthropods of domestic chicken in Amansea and Ifite communities. There was no significant difference in the prevalence of ectoparasitic arthropods between the two communities. Therefore, further study is needed to determine the impact of infestation on the health and productivity of these birds, and evaluation of cost benefit of various control strategies need to be investigated.

Keywords: Gallus domesticus; ectoparasites; prevalence; arthropods; free-range; chicken.

1. INTRODUCTION

In Nigeria, a lot of emphasis has been placed on modern poultry production and management using exotic breeds of chicken. Poultry farming embraces hunting, domesticating, keeping and raising of these birds for purposes such as meat and egg production intended for human consumption [1]. Despite this, a substantial proportion of the chicken consumed in the country is local breed raised in the villages as free rangers, particularly in the northern part of Nigeria where modern poultry production is not well developed [2]. Field studies show that poultry farming maintained under free range conditions can be heavily parasitized, therefore, control measures such as preventing infections are likely to improve weight gain and egg production. The vast majority of this bird population are reared mainly in local villages, while about 5% are reared in the urban centers under the extensive system of management leaving a small fraction, about 10% that is intensively managed in various parts of the country [3].

Chicken can be managed using two systems namely, open (free - range) and restricted (confined system). In free -range system, chickens move about freely over a wide area in search of food. They are always hardy, breeding is natural, which in turn saves hatchery costs and other expenses and their strong nature may partially be expressed in disease resistance [4].

In the rural system of poultry management, the birds are left to scavenge around the house during the day time to obtain what feed they may be able to get from the environment often as offal, insects and seeds. Owing to the free range and scavenging attitude, traditional village birds are in permanent contact with soil and insects. Soil when humid and warm may serve as an important reservoir transmission site for external larval stages of parasites [5].

During feeding process, in places such as refuse dumps and in farm yards around houses, chicken become infected as they pick up eggs of helminthes and intermediate hosts of these parasites which are usually annelids and arthropods [6]. Free range chicken are exposed to various natural hazards which include adverse weather conditions, predators (such as hawks), and parasites. Therefore, such chicken are at the mercy of environmental hazards and infectious agents [7].

Parasitism ranks high among factors that threaten free range chicken production [8]. Arthropod ectoparasites have a major impact on husbandry, productivity and welfare of domestic animals [9]. Due to their numerous activities, ectoparasitic arthropods have two types of effects on their host, which are direct and indirect effects. Direct damages caused according to Richards and David [10], are blood loss, myiasis, skin inflammation, pruritis with toxic and allergic responses caused by antigens and anticoagulants in the saliva of blood feeding arthropods. Ectoparasitic arthropods such as ticks, suck blood and interfere with the feed consumption by giving continuous irritation. Thus, they are associated with emaciation, anaemia and eventually loss of production. In some cases, severely affected birds may die [11]. The major effects of these parasites on their host are due to the irritation they cause. Ectoparasites found on poultry birds belong to Phylum Arthropoda, and of two classes: Arachnida, having the Orders Acarina (ticks and mites) and the Insecta which includes the following Orders Phthiraptera (lice), and Siphonaprera (fleas) [12,13]. Ectoparasitic arthropods carnage feathers, irritate and cause skin lesions, resulting in reduced performance of adult chicken and direct harm to young chicks [14].

Ectoparasitic arthropods also cause indirect damage, when they are present at high density

causing: disturbance, self-wounding and social nuisance. Parasites may cause a clinical problem by transmitting a number of infectious diseases pathogens and, can also act as intermediate hosts of a range of helminth parasites [14]. Moyer [15] stated that a parasite's potential effect can influence the life history strategy of its host. In environments with high parasite pressure, hosts invest more in anti-parasite defense, which may limit their investment in other life history components, such as survival and production. The control of ectoparasites is rarely practiced and in many cases lead to severe infestation, which results in reduction in reproduction rate, egg production and poor health. In addition, the ectoparasites are also capable of acting as vector of a range of pathogens [16].

Permin and Bisgaard [17] Observed that, mismanagement, predation, thefts, lack of supplementary feeding and parasite infestations are factors that affect the free range system in Africa, as they cause 80-90% mortality of local free range chicken. Losses have also been attributed to limited housing and veterinary care services [18]. Permin and Bisgaard [17] Also reported that mortality due to parasitic diseases was higher than those attributed to Newcastle disease. Parasitic diseases in poultry, being the major disease of birds, have many effect on the birds which include reduced growth and egg production, emaciation and anaemia as well as mortality. The aim of this study is to identify the taxa of ectoparasitic arthropods that infest free-range domestic fowls *(Gallus domesticus)* in Amansea and Ifite communities in Awka capital Territory and to determine the prevalence of such parasites amongst the free range *G. domesticus* and their levels of infestation in the different localities.

2. MATERIALS AND METHODS

2.1 Area of Study

This study was carried out in Amansea and Ifite communities within the Awka Capital Territory. Awka is the Capital city of Anambra state, Nigeria and is situated about 72 km away from Enugu and 45 km from Onitsha, along Enugu-Onitsha highway. Awka is situated in the rainforest belt of Nigeria and has two clearly demarcated seasons: a wet season from April to October and a dry season from November to March. The people of Awka practice both intensive and extensive poultry management system. Amansea and Ifite are communities within the Awka Capital Territory, and are separated by a small marshy stream. This study was carried out from June to September, 2014.

2.2 Collection and Examination of Chicken for Infestation by Ectoparasitic Arthropods

A total of 112 chicken (*G. domesticus*), 56 from Amansea and Ifite respectively, were used for this study. The chicken were caught at night from their sleeping/roosting sites on trees and cages. The chicken were examined for ectoparasitic arthropod infestation in the morning of next day. A careful approach was followed to detect and collect the ectoparasites. A hand lens was used to examine the different parts of the chicken for ectoparasites. A white cloth was spread on the ground while examining the chicken and during examination of the fowls, the head of the chicken was examined first, followed by the neck, body sides (using a soft brush for combing of the feathers), vent area and legs as described by Banda [19]. The sample consisted of 42 adult males, 30 adult females and 40 juveniles.

2.3 Collection and Preservation of Ectoparasites

Ectoparasites such as ticks were removed with the aid of a forceps and cotton wool soaked with alcohol to paralyze the ticks, for easy extraction. Lice were collected from hosts by dipping a dissecting forceps in absolute alcohol before extracting the lice. The alcohol instantly paralyzed the lice and thus made collection easier. Mites and fleas were collected by brushing of the head and body of the fowl as described by Mukaratirwa and Khumalo [16] Bala [20]. All the parasites collected were counted and placed in sampling bottles containing 70% ethanol. Each fowl examined was assigned a serial number on the sampling bottle for ease of identification. All parasites collected were sent to the department of Zoology Laboratory in Nnamdi Azikiwe University, Awka for thorough study and identification.

2.4 Identification of Ectoparasites

The ectoparasites were placed on a microscopic slide and viewed with the aid of a dissecting and binocular microscope to study their morphological characteristics for identification. The identity of the ectoparasites was established using identification guides by Wall and Shearer [21].

2.5 Statistical Analysis

The data obtained was analyzed and Chi-squared test was used to test for possible significant differences between the parameters investigated, using SPSS statistical software package.

3. RESULTS

A total of 73.21% out of the 112 fowls examined were infested by one or more species of ectoparasitic arthropods. 88.01% of the 42 adult male chicken were infested by one or more species of ectoparasitic arthropods. 80.00% out of 30 adult female chicken were infested by one or more species of ectoparasitic arthropods while 52.50% out of the 40 juvenile chicken were infested.

Table 1 shows that of the 56 *G. domesticus* examined in Ifite, 67.86% were infested while 78.57% of the 56 *G. domesticus* examined in Amansea were infested by ectoparasitic arthropods. Also, of the 17 adult males examined in Ifite, 82.35% were infested while 92.0% of the 25 *G. domesticus* examined were infested in Amansea. However, adult females 70.0% of the 20 adult females examined in Ifite were infested while all 100.00% adult female birds examined in Amansea were infested. Of the 19 juvenile *G. domesticus* examined in Ifite, 52.63% were infested while 52.38% of the 21 juveniles examined in Amansea were infested. Chi-squared test showed the differences in prevalence among the categories of *G. domesticus* by age were significant (P<0.05) in both communities.

A total of 41.07% of the chicken examined were infested by lice, 10.71% by flea, 16.07% by mite and 29.46% by tick. Table 2 shows that out of the 112 *G. domesticus* examined, 23.21% were infested by *M. gallinae,* while 12.50% and 5.36% were infested by *L. caponis and G. gallinae* respectively. *E. gallinacea* was recorded to infest 10.71% of the 112 birds examined while 16.07% and 29.46% were infested by *D. gallinae and A. persicus* respectively. Table 2 also shows that out of the 56 *G. domesticus* examined in Ifite, *M. gallinae, L. caponis and G. gallinae* infested 23.43%, 10.71% and 10.71% respectively, while out of the 56 *G. domesticus* examined in Amansea, *M. gallinae* and *L. caponis*

Table 1. Prevalence of ectoparasitic arthropods on free range G. *domesticus* in amansea and ifite communities, Awka

Sex/ stages	Amansea			Ifite		
	N.E	N.I	Prevalence %	N.E	N.I	Prevalence %
Adult males	25	23	92.0	17	14	82.35
Adult female	10	10	100.0	20	14	70.0
Juveniles	21	11	52.38	19	10	52.63
Total	56	44	78.57	56	38	67.86

Keys:- N.E- Number examined, N.I - Number infested

Table 2. Prevalence of ectoparasitic arthropod species on *G. domesticus* in ifite and amansea communities

Ectoparasite species	Amansea			Ifite			Total prevalenc (^{x}/112)%
	N.E	N.I	Prevalence%	N.E	N.I	Prevalence%	
Lice	56	22	39.29	56	24	42.86	-
M. *gallinae*	56	14	25.0	56	12	2.1 .43	23.21
L. caponis	56	8	14.29	56	6	10.71	12.5
G. *gallinae*	56	0	0	56	6	10.71	5.36
Fleas							
E. gallinacean	56	11	19.64	56	1	1.79	10.71
Mites							
D. gallinae	56	8	14.29	56	10	17.86	16.07
Ticks							
A. persicus	56	16	28.57	56	17	30.36	29.46

Key.-N.E - Number examined, N.I - Number infested

infested 25.0% and 14.29% respectively. *G. gallinae* was not recorded in the survey at Amansea. *E. gallinacea* was recorded on one bird only out of the 56 *G. domesticus* examined in Ifite 10.71% while *E. gallinacea was* recorded to occur on 19.64% of the 56 G. *domesticus* examined in Amansea. Table 2 also shows that out of 56 G. *domesticus* examined in Ifite, 17.86% were infested by D. *gallinae* while 14.29% of the population examined in Amansea were infested. *A. persicus,* the soft tick, infested 30.36% of the population examined in Ifite while 28.57% were infested in Amansea, out of the 56 *G. domesticus* examined. Table 2 shows that *A. persicus* 29.46% had the highest overall prevalence followed by *M. gallinae* 23.21% and *D. gallinae* 16.07% while *G. gallinae* 5.36% had the lowest overall prevalence. Chi-squared test revealed that there was significant difference in the prevalence of the species of ectoparasitic arthropods between fowls from the two communities ($P<0.05$).

4. DISCUSSION AND CONCLUSION

A total of 82 domestic fowl (*G. domesticus*) were infested having a prevalence of 73.21%. The prevalence of 73.21% of ectoparasitic arthropods recorded in the present study is appreciably higher than the figures of 40.5% recorded by Ikpeze [2] for chicken in Eke Awka market and 41.0% recorded by Nnadi and George [18] for chicken in Enugu State but lower than the figures of 86.6% reported by Shanta et al. [22] for India. The observed differences in prevalence in these studies may be a result of differences in management system which exposed the domestic fowl to various ectoparasitic arthropods [23], since they scavenge through a wider area of the farmers' house that makes them more exposed to the source of infestation. Differences in prevalence of ectoparasitic arthropods could also be due to varying ecological factors such as humidity and temperature. Although the root causes of high infestation rate with ectoparasitic arthropods in domestic fowls in the present study are not clear but extensive management systems, where the chicken have access to outdoor areas and not confined, do have a greater diversity of parasites [24]. Chi-squared test showed that the difference in prevalence of ectoparasitic arthropods between the two communities is significantly different ($P<0.05$).

According to the results of the present study on (Table 1), adult males had a higher prevalence (33.04%) of ectoparasites, than adult females (21.43%), and juveniles (18.75%).The findings differ from those of [25] and [2] both of which recorded that the prevalence of ectoparasites was higher in females than in males, as well as with the findings of Sabuni [24], which recorded the same prevalence (95.8%) in male and female chicken. Chi-squared test showed a significant difference in the prevalence of ectoparasites among adult males, females and juveniles ($P<0.05$). The factor(s) responsible for the differences in prevalence between adult males and females, and between adults and juvenile chicks as recorded in the present study is/are not known. However, Shanta [22] noted that male sex hormones make birds more susceptible to parasitic infection resulting to a higher mean parasitic burden. The results of this study showed that domestic chicken in Amansea had higher prevalence of ectoparasitic arthropod infestation (78.57%) compared to Ifite (67.86%) as well as with the findings of Sabuni [24], which recorded that lower midlands zone were found to be slightly higher compared to prevalence of ectoparasitic arthropods in lower highland zone land suggested that the difference could be due to a variation in rainfall, temperature and altitude. The present study was carried out during the rainy season and as such the effect of seasons on the prevalence of ectoparasitic arthropods cannot be speculated upon.

In this study (Table 2), lice were the most prevalent (41.07%) and commonly found ectoparasitic arthropods followed by ticks (29.46 %), mites (16.07%) and fleas (10.71%). This finding is in agreement with the earlier studies by Nnadi [18]; Sabuni [24] and Bala [20], in Enugu, Kenya and Sokoto respectively. The prevalence rate of the parasite from those studies were 41% [18], 90% [24] and 27.5% [20]. However, the result of Biu [25] and Banda [19] differ with the findings of the present study. [25] reported *A. persicus* to be the most prevalent ectoparasitic arthropod encountered during their studies in Maiduguri, while Banda [19], reported *C. mutans* to be the most prevalent ectoparasite with an overall prevalence rate of 99% of the entire population of chicken examined, followed by *E. gallinacea* (52.2%) and *M. gallinae* (34.0%). The observed differences in the most prevalent ectoparasitic arthropod species in the different locations may be due to differences in climatic and topographic conditions as well as species adaptability.

Three species of lice were recorded during the present study (Table 2). Those were *M. gallinae, L. caponis and G. gallinae,* with *M. gallinae* being the most prevalent species. This finding

corroborates the result of earlier studies in different geographical location Sabuni [24] in Kenya, Ikpeze [2] in Eke-Awka market, Bala [19] in Sokoto, Mukaratirwa and Khumalo [16] in South Africa, and Tabasak [26] in Thailand. However, [22] found *M. stramineus* as the most prevalent lice species. It would therefore seem that *M. gallinae* is the most widely distributed of lice species in free range *G*. *domesticus.*

A. persicus was the only tick species found in this study, and had a prevalence of 29.46%. The prevalence of this species recorded in the present study is rather high when compared to the figures of 5.6% and 8.8% reported by Sabuni [24] and Banda [19] respectively. However, the prevalence rate of *A. persicus* in Ifite was higher compared to Amansea, and this could be due to differences in ecological factors.

One species of mite, *D. gallinae,* was found in the study, and had a prevalence of 16.07%, which is higher than the figures obtained for the species by Banda [19] and Bala [20] who recorded a prevalence of 8.1% and 4.4% respectively, but lower than the figures of 57% obtained by Shanta [22]. *D. gallinae* was found also on adult females and juveniles only in both communities, a finding which does not lend itself to plausible explanation at the moment.

One species of chicken flea *(Echidnophaga gallinacean*) was also found in the present study (Table 2), at a prevalence of 10.71%, which is comparatively lower than the records of the previous studies in Thailand, 20.0% Tanasak [26], Kenya, 29.2% Sabuni [24], Malawi, 52.2% Banda [19] and Eke-Awka, 69.37% Ikpeze [2]. The observed differences in prevalence for the species could be due to variation in ecological factors prevalent in the areas of study. In the present study, flea infestation varied with sex and age of chicken, and also between the communities (Amansea and Ifite), although there was no significant difference in the prevalence of the ectoparasite species in the two communities.

In conclusion, the present study has provided information on the various ectoparasitic arthropods of domestic chicken in Amansea and Ifite communities. There was no significant difference in the prevalence of ectoparasitic arthropods between the two communities. Therefore, further study is needed to determine the impact of infestation on the health and productivity of these birds, and evaluation of cost benefit of various control strategies need to be investigated.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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