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Economic Importance and Widespread of Ectoparasites Infestation in Indigenous Chickens (*Gallus gallus domesticus*). A Study from Selected Local Government Councils and States in Nigeria

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***[1]Ahaotu, E. O., [2]Akinfemi, A. and [3]Okorie, K. C.**

[1]Department of Animal Production Technology, Imo State Polytechnic Umuagwo, Nigeria.
[2]Department of Agricultural Technology, Yaba College of Technology Epe Campus, Lagos State, Nigeria.
[3]Department of Animal Science and Fisheries, Imo State University, Owerri, Nigeria.
*Corresponding Author E-mail: emmaocy@yahoo.com

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A cross sectional study was conducted from June 2016 to August 2017 to identify the widespread of ectoparasites in indigenous chickens and its associated economic significance in randomly selected Local Government Councils and States in Nigeria. A total of 1025 indigenous 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 widespread. 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 were highly prevalent among indigenous chicken flocks, which may likely affect their optimum productivity. Routine prevention and control of ectoparasites should be encouraged in the study areas.

Keywords: Indigenous chickens, ectoparasites, infestations, selected local government councils and states in Nigeria.

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 (Ahaotu *et al.,* 2017a and Angyiereyiri *et al.*, 2015). It also serves as a source of easily disposable petty income for the rural dwellers (Alders *et al.*, 2009 and Ahaotu *et al.,* 2016a). They require little labor intensity, affordable inputs and low initial investment compared to other livestock production activities (Ahaotu *et al.,* 2018a). It is also reported that indigenous poultry play significant roles through their contribution to the cultural and social life of rural dwellers (Ahaotu *et al.,* 2016b; Mwale and Masika, 2009). Among the village poultry species, indigenous chicken in Nigeria represents a significant part of the national and the rural economy in particular (Lawal *et al.*, 2015; Ogbuokiri *et al.,* 2015). Unfortunately, the majority of these chickens are maintained under traditional system with little or no inputs for housing, feeding or veterinary care (Geidam *et al.*, 2011). These birds can easily be exposed to harsh environmental conditions or be infected with several types of diseases such as bacterial, viral, fungal and parasitic pathogens (Ahaotu *et al.*, 2018b). Among various parasitic diseases, ectoparasites infestations are of great economic importance in indigenous chicken production systems (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 (Nyoni and Masika, 2012 and Onwuasor, 2017). Ecto-parasitism has been identified as one of the major factors that threaten scavenging indigenous chicken production systems in developing countries (Ononiwu *et al.,* 2017 and Zumani, 2011). Mortalities due to parasitic diseases is higher than those attributed to some poultry viral infectious diseases such Newcastle disease and fowl pox disease (Opara *et al*., 2014). Common ecto-parasites of village chickens range from lice, mites, fleas and ticks (Nnadi and George, 2010). Some of the ectoparasites, especially tick and mites acts as vectors of poultry diseases such as Pastuerellosis, Fowl Pox, Newcastle disease and possibly chlamydia (Moyo *et al.,* 2015). Parasitic infection has been known to result in immunosuppression, especially in response to vaccines against some poultry diseases (Ahaotu *et al.,* 2018c). High losses of indigenous 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 (Amede *et al*., 2011). Ectoparasites may be a considerable constraint to Nigerians efforts to achieve increased production of indigenous chickens and products to enhance food security, poverty alleviation and improvement of job creation among youths so as to meet the demand of the fast growing populace of the country. Information available on the widespread of ectoparasites in indigenous chickens in some parts of Nigeria are those of Usman *et al*. (2012) in Sokoto State northwestern Nigeria, Ekpo *et al*. (2010) in Abeokuta, Ogun State, South Western Nigeria, Eneanya *et al.* (2008) in Akwa – Anambra State, South Eastern Nigeria and Biu *et al.* (2012) in Maiduguri North Eastern Nigeria. At present, no routine government policy and activity is in place for routine control and prevention of indigenous chicken ecto-parasites in Nigeria. Adequate control practice of ecto-parasites in rural areas is not carried out. Research on ecto-parasitism of livestock has mostly been concentrated on ticks and biting flies in ruminants (Cattle, sheep and goats) because of economic significance of ecto-parasite borne diseases (Adang *et al*., 2015). Specific objectives are to determine the prevalence of ecto-parasites in village chickens and to evaluate the economic significance of ecto-parasites infestation in Nigeria.

MATERIALS AND METHODS

The study was carried out at Akwa-Ibom, Ogun, Anambra, Sokoto, Rivers, Oyo, Kano and Imo selected states in Nigeria. The randomly selected states are densely populated. The states are located within the lowland coastal plain of Nigeria. Akwa-Ibom State lies between latitudes $4^{\circ}\ 32^{1}$ and $5^{\circ}33^{1}$ North and longitudes $7^{\circ}\ 35^{1}$ and $8^{\circ}\ 25^{1}$ East; Bayelsa State lies within the latitude of $4^{\circ}15^{1}$ and $5^{\circ}23^{1}$, longitude $5^{\circ}15^{1}$ and $6^{\circ}\ 45^{1}$ and longitude $05^{\circ}\ 22^{1}$ West while Kano State lies between latitude 13°N in the North and 11°N in the South and longitude 8°W in the West and 10°E in the East. The major occupations of the people are trading, public service and farming. Many do combine farming with other occupation like tailoring, masonry and transportation. A total of 1200 questionnaires were distributed among randomly selected participants in selected communities and states in Nigeria. The selected local government councils were shown in (Table 1). Fifty questionnaires were distributed per local government council and 150 distributed per town. Out of the one thousand two hundred questionnaires distributed, only seven hundred and twenty (720) were collected back for analysis. The smallholder poultry farmers responded to 700 questionnaires and the data obtained from the study were analyzed using descriptive statistics such as range, mean, frequency and percentages.

Table 1. Selected study sites.

States	Local Government Councils
Akwa -Ibom	Eket, Ikono and Mbo
Ogun	Ifo, Ikenna and Odeda
Anambra	Aguata, Dunukofia and Ogbaru
Sokoto	Bodinga, Rabah and Tureta
Rivers	Okrika, Eleme and Gokana
Oyo	Akinyele, Irepo and Iwajowa
Kano	Dawakin, Kiru and Tudun Wada
Imo	Ngor Okpala, Obowo and Orsu
Zamfara	Bungudu, Maradun and Zurimi
Ondo	Idanre, Ilaje and Owo

Sampling procedure

One thousand and twenty five village chickens which comprises of both sexes and various ages were sampled from randomly selected states and local government councils in Nigeria. Household with moderately large numbers of village chickens population and that were 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 ecto-parasites infestations. Samplings were carried out for a period of six months on weekly basis. Ecto-parasites were collected from the body and skin of each bird and not from the ground in order to minimize accidental collections of other arthropods that do not actually parasitize birds. Examinations for ecto-parasitic infestations were carried

out early in the morning and in the evening.

Parasitological procedures

Investigation for ecto-parasites infestation in birds were 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). Ecto- parasites 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 and skin of the bird onto a white blotting paper (Hobbenaghi *et al*., 2012). The parasites collected were preserved in 70% ethanol in well labeled glass vials and other data were recorded accordingly.

Ecto-parasite identification

Ticks, lice, fleas and mites were identified according to keys and descriptions by 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.

RESULTS AND DISCUSSION

Table 2 shows the results of the prevalence ecto-parasites infestation in randomly selected Local Government Councils and States in Nigeria according to study locations. Out of the thirty different study locations visited for village chicken examination in Nigeria, the following prevalent rates were encountered in descending order: Imo State (97.2%), Akwa – Ibom State (94.8%), Anambra State (94.1%), Rivers State (93.0%), Zamfara State (91.5%), Ondo State (89.0%), Sokoto State (89.9%), Ogun State (88.6%), Oyo State (86.5%) and Kano State (80.9%) respectively. Table 3 shows the results of the ecto-parasites infestation in randomly selected Local Government Councils and States in 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 ecto-parasites, 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 ecto-parasites 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 4 shows the results of the prevalence of different species of ecto-parasites according to the infested anatomic site on village chickens in randomly selected Local Government Councils and States in Nigeria. Lice (85.8%) were the most prevalent ecto-parasite 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).

The present study further revealed the occurrence of various species of ecto-parasites within different external anatomical parts of village chickens following thorough body examination of each randomly sampled bird. It has been established that ecto-parasites are important constraints to village chickens production system. This study have revealed varying prevalent rate of ecto-parasitism in village chickens with higher prevalent rates of 97.2%, 94.8% and 94.1% encountered in Imo State, Akwa – Ibom State and Anambra State respectively while 86.5% and 80.9% prevalent rates were found in Oyo State. Four types of ecto-parasites genera were encountered in this present study in all the study areas. The prevalence of ecto-parasites 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). Ecto-parasites were found on different body parts of the examined chickens. Wherever part of the birds' body ecto-parasites 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 (Hobbenaghi *et al*., 2012). The observed overall prevalence rate of ecto-parasites (90.7%) in village chickens from the study areas were considerably

Table 2. Prevalence of Ecto-parasites in village chickens in randomly selected local government councils and States in Nigeria.

Study location	Number of chickens (n=1025	Number of chickens affected	Relative Prevalence (%)
Akwa-Ibom State (Eket, Ikono and Mbo)	95	91	94.8
Ogun (Ifo, Ikenna and Odeda)	105	93	68.6
Anambra (Aguata, Dunukofia and Ogbaru)	101	95	94.1
Sokoto (Bodinga, Rabah and Tureta)	99	89	89.9
Rivers (Okrika, Eleme and Gokana)	114	106	93.0
Oyo (Akinyele, Irepo and Iwajowa)	96	83	86.5
Kano (Dawakin, Kiru	89	72	80.9
Imo (Ngor Okpala, Obowo and Orsu)	108	105	97.2
Zamfara (Bungudu, Maradun and Zurimi)	117	107	91.5
Ondo (Idanre, Ilaje and Owo)	100	89	89.0
Total	1025	930	90.7

Table 3. Ecto-parasites encountered according to parasitic infestation (single or mixed infestations) in randomly selected Local Government Councils and States in Nigeria.

Parasitic Infestation	Type of Ecto-Parasite 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
	Lice and Fleas	52	5.1
	Lice and Mites	461	45.0
Mixed Infestations	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

high, which indicated that ecto-parasite infestation is a common problem among this class of poultry in the study areas. This high prevalence of ecto-parasitism may be associated with the provision of poor housing facilities 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 ecto-parasitic 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 (Tolossa and Tafesse, 2013); Ghana (Angyiereyiri *et al*., 2015); Zimbabwe (Mukaratirwa and Hove, 2009); Nigeria (Bala *et al*., 2011, Ogbuoiri *et al*, 2011a). 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% (Bala *et al*., 2011) have been reported in different studies. 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, agro-ecological, and implemented methods of the parasitic control (Mekuria and Gezahegn, 2010). This study was conducted during rainy season towards early dry season of the year (August to January) while others might have conducted ecto-parasites samples collection during the dry season of the year (Belihu *et al*., 2010) or during heavy rainy season (Ogbuokiri *et al*., 2011b). Ecto-parasites infected chickens in the present study were found to harbour single or mixed infestation of ecto-parasite species. 17.0% of the total examined chickens

Table 4. Prevalence of different species of ecto-parasites according to the infested anatomic site on village chickens in randomly selected local government councils and States in Nigeria.

Types of Ecto-Parasites	Species of Ecto-Parasites Encountered	Prediction Site	Total Number of Birds affected	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
	Cnemidocoptes mutans	Lower limbs (Non Feather areas)	347	33.9
	Dermanyssus gallinae	Entire body	142	13.9
Mites				
	Epidermoptes species	On the body	173	16.9
	Laminosioptes cysticola	On the subcutaneous tissue	32	3.1
	Megninia species	On feathers (Quills)	28	2.7
	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

were found to be infested with single species of ecto-parasites while 73.9% were infested with mixed ecto-parasitic infestation. The mixed ecto-parasitic infestation of chickens found in this study was lower than 81% ecto-parasitic 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 ecto-parasitic control measures were adopted in the various study areas. Ten species of ecto-parasites, 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 ecto-parasites respectively in village chickens during a similar study. This indicates widespread of these ecto-parasite 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 ecto-parasite species found on the examined village chickens*, Menopon gallinae* was most frequently identified (50%) species while *Megninia species* (2.7%) was the least encountered ecto-parasite species. The prevalence of 22.1% of *Lipeurus caponis* encountered in this study is 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 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. 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 ecto-parasites 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; Ahaotu *et al.,* 2017d), companion animals (cats, dogs) (Shitta *et al*., 2011 and 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 (Ahaotu *et al*., 2017c). Widespread 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; 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 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 ecto-parasites infestations are highly prevalent in scavenging village chickens production and management system which is associated with inadequate hygienic system, poor husbandry and management, lack of Strategic ecto-parasites control practices. In most villages chicken production system, the economic importance of ecto-parasites 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.

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