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Survey of Ectoparasites Infesting Captive Birds in the Jos Museum Zoological Garden, North Central, Nigeria

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Abstract
Many ectoparasites are known vectors of many diseases causing pathogens. Thus a survey of ectoparasite infesting captive birds in the Jos Museum Zoological Garden, Plateau state, north central Nigeria was carried out using direct collection method between February to July 2014. A total of 13 individuals of captive birds of non-passeriformes group belonging to 8 orders, 8 families and 13 species were sampled using five predilection sites. A total of 58 ectoparasites distributed across 3 orders were collected. Out of the 13 bird species sampled, six were found to be infested with ectoparasites. There is a significant difference (X^2 = 158.069, df = 12, P = 0.001) in ectoparasitic load in relation to birds species. There is no significant difference (X^2 = 4.069, df = 4, P = 0.39) in ectoparasitic load in relation to predilection sites. However, there is a significant difference in ectoparasitic load in relation to predilection sites of some bird species sampled (marabou stork: X^2 = 32.4286, df = 4, P = 0.001; Ostrich: = 24, df = 4, P = 0.001; crown crane: X^2 = 22.8696, df = 4, P = 0.001). The wing, back and neck are the most infested predilection sites. This study revealed a low ectoparasites infestation in captive birds in the Jos Museum Zoological Garden which was attributed to serious preening and allo-preening carried out by some bird species as means of combating ectoparasites. It is therefore important that periodic inspection be carried out to reduce incidence of ectoparasites infestation.
Keywords: Captive birds, Ectoparasites, Jos, Museum, Zoological Garden

1. Introduction

Ectoparasites are organisms that live on the outer surface of their host (Hamilton, 1982). Clayton and Walther, (2001) described ectoparasites as organisms that are semi-dependent on their host, and adapted to live on the external surface, but are able to survive without the host for certain period of time. Many ectoparasites are known to be vectors of many disease causing pathogens (Nelson and Micky, 2000). However ectoparasites especially in large aggregation can debilitate wild birds by causing irritability, dermatitis, skin necrosis, low weight gain, secondary infection, blockage of orifices e.g. ear, inoculation of toxins and occasionally exsanguination, while others like lice eat the dead cells of skin and its appendages (Clayton and Walther, 2001). In general, an increased transmission of ectoparasites is usually considered to be a universal cost group-living, where social animals have a greater chance of acquiring and accumulating ectoparasites due number of physical contacts among group members than among solitary individuals (Alexander, 1994). However, few studies in birds have demonstrated this cost of group-living in nesting colonies of swallows (Family: Hirundinidae) For instance, positive relationships have been observed in Bank swallows (*Riparia riparia*) between colony size, mean number of fleas per nest and the percent of fleas infested nests per colony (Alexander 1994).

Captive birds are caged birds living in man-made conditions (Padian and Chiappe, 1997). Some of these birds are important to humans economically and important to other animals and plants as they serve as source of food, pollinators and good indicators of certain happenings in the environment (Ruppert, *et al.,* 2004). Almost all species of captive birds suffer from ectoparasite infestation (Loye and Carrol, 1995). The adverse effect exerted by ectoparasites cause selection pressure on the avian host (Moller and Lope, 1990) by lowering nestling survival and growth, influencing the evolution of birds coloration and increasing cost of sexual ornamentation, reducing future reproductive success and decreasing long term survival. These ectoparasites also affect the management of wild birds, other wild animals and the health of both domestic animals and humans (Brown *et al*., 1996). This has called for a more careful survey of their infestation strategies, transmission and control in other to reduce their prevalence among captive birds and other animals in general (Nelson and Micky 2000). Thus, this study is to investigate the prevalence of ectoparasites infesting captive birds in the Jos Museum Zoological Garden, Plateau state, north- central, Nigeria.

2. Materials and Methods

2.1 Study Area

Geographically, Jos Plateau lies between latitudes 8° 30' and 10° 30' North and longitudes 7° 30' and 8° 37' East (Ajakpo and Okonkwo, 1984).

The Jos Museum was founded in December, 1955 and was approved in June 1960 when the Zoological Society of Nigeria was formed to manage it. Jos Museum is the second oldest museum in Nigeria, after the small museum at Esie, near Ilorin, which was opened in 1945. It is located in the heart of the city of Jos, Plateau State, North-Central Nigeria and found on longitude 9°54' 51"North and latitude 8° 53' 9"East (Ajakpo and Okonkwo, 1984).

2.2 Sampling Period and Method of Collection

This study was carried out between February to July, 2014. The birds were restrained by the zoo keepers. The heads of birds were held in a steady position in order collect ectoparasites. Collections were carried out forth nightly using the direct collection method of Iwuala and Okpala, (1980). Ectoparasites were grasped with flat forceps placed right across them, so that the tips did not penetrate and damage the parasite, and as near to the anterior as possible to prevent decapitation, then turned over and gently pulled away from the skin. They were placed immediately in 75% ethanol and 5% glycerine. The Glycerine was to prevent the ectoparasites from becoming brittle as the alcohol evaporated. Ectoparasite such as tick that adhere firmly to the skin were first dab with cotton wool soaked in formalin, which help to loosen the grip of the tick and then collected using a pair of forceps.

Collection of ectoparasites followed a strict routine of five predilection sites namely wings, trunk, back, tail and neck of birds. A total of ten minutes was spent on each bird species, with each part of the bird examined for two minutes to avoid biased. The collected ectoparasites were placed in a labeled specimen bottles bearing collection site, common name of bird and date of collection.

2.3 Preservation, Processing and Identification of Ectoparasites

Ectoparasites collected were preserved in specimen bottles containing 75% ethanol and 5% glycerine. These were conveyed to the laboratory for processing and identification. Bigger ones like ticks were identified directly without processing. Identification of ectoparasites was carried out using identification keys provided by Hoogstraal (1956); James and Harwood (1969) and Soulsby (1982).

2.4 Statistical Analyses

Data obtained were analyzed using R Console software (Version 2.9.2). Proportions were compared using Chi-square test. Statistical significance was achieved if $P < 0.05$.

3. Results

The captive birds examined during the study period were infested to varying degrees by different types of ectoparasites (Table 1). A total of 58 ectoparasites distributed across 3 orders and 8 species were collected from 13 individuals of captive birds of non-Passeriformes group belonging to 8 orders, 8 families and 13 genera. The lice were the most prevalent ectoparasites infesting captive birds in the Jos Museum Zoological garden. The Comparison of Ectoparasites infestation revealed that the Crown crane, Geese and Peacock showed only lice infestation, the Marabou stork and Ostrich showed both lice and tick infestations, while the Wild duck was the only bird species that showed mite infestation (Table 1).

There was a significant difference ($X^2 = 158.069$, df = 12, P = 0.001) in the prevalence rate of ectoparasites in relation to captive birds (Figure 1). The Crown crane (Gruiformes: Gruidae) had the highest prevalence rate of ectoparasites, while the Geese (Anseriformes: Anatidae) had the lowest prevalence rate of ectoparasites as shown in Figure 1. However, Bateleur Eagle, Black kite, Hawk Eagle, Martial Eagle, Palmnut Eagle (Falconiformes: Accipitridae), Grey Heron (Pelecaniformes: Ardeidae) and Owl (Strigiformes: Strugiformes) had no ectoparasites (Figure 1).

There is no significant difference ($X^2 = 4.069$, df = 4, P = 0.39) in ectoparasitic load in relation to predilection sites (Figure 2). However, there is a significant difference in ectoparasitic load in relation to captive bird species and predilection sites (marabou stork: $X^2 = 32.4286$, df = 4, P = 0.001; ostrich: = 24, df = 4, P = 0.001; crown crane: $X^2 = 22.8696$, df = 4, P = 0.001) as shown in Table 2.

4. Discussion

The most important result in this preliminary study is the documentation of ectoparasites species infesting captive birds in the Jos Museum Zoological Garden. The information on the prevalence rate of these ectoparasites in captive birds is important because many of these ectoparasites have severe negative effects on host fitness (Soulsby, 1982). The study has showed that the most prevalent ectoparasites among the captive birds were the lice. This is consistent with the findings of De Oliveira *et al*. (2011) where they likewise observed among the Raptors that lice were the most prevalent ectoparasites. The variations in the prevalent rate of these ectoparasites in captive birds of the Jos Museum Zoological Garden is attributed to a number of factors such as sanitation and environmental factors. This was also reported by Viljoen *et al*. (2011) who presented that the

occurrence and distribution of ectoparasites may be due to environmental factors and susceptibility of the hosts. The zero ectoparasitic load among the Falconiformes in this study was probably because the birds engage in serious preening and allo-preening as a means of combating ectoparasites which is in agreement with the findings of Morishita *et al.* (2001) who reported that captive birds normally harbours small number of chewing lice that may increase in number if the hosts are unable to preen themselves. Dale *et al.* (2010) working on how birds combat ectoparasites revealed that preening is a critical defense against ectoparasites.

The high significant difference in ectoparasitic load in relation to captive bird species and predilection sites was due to differences in the location, nature of their cages and maintenance strategy imbibe by each bird to combat ectoparasites. This is consistent with the findings of Yakubu (2006) who also found significant difference in ectoparasitic load in captive birds in the Tijany wild life technology, Gwarimpa, Abuja Nigeria. He attributed this significant difference to maintenance strategies use by captive birds.

However Santos (2010), in his works found a low significant difference in ectoparasitic load among the Raptors at the Yutican wildlife park, southern Mexico. This is similar with the findings in these study where the wild duck and geese showed lowest ectoparasitic load, due to preen and allo-preen, they engaged in and also presences of a small pool which they use for water bathing, all as means of combating ectoparasites. The crown crane showed highest number of ectoparasites infestation which is attributed to the uncemented floor of their cages which could enhance the incidence of ectoparasitism. This is in conformity with the findings of Hebb *et al*. (2000) and Edosomwan and Amadasun (2008) who also revealed that poor hygienic conditions of cages provide harborages for ectoparasites and since animal movement is restricted these could result to higher ectoparasite infestation. Collaborating report from Omudu, *et al.* (2011) that nest and cage materials provided for the comfort of animals in captivity are key habitats for ectoparasites species to live and reproduce within them.

The no significant difference in ectoparasitic load in relation to predilection sites of birds by ectoparasites was due to lack of preference to specific body parts, therefore their utilization of all body parts of captive birds. This is in contrast to the findings of Morishita *et al.,* (2001), where the trunk of birds are the preferred predilection site for lice followed by the head region.

5. Conclusion and Recommendation

Captive birds in the Jos Museum Zoological Garden showed low ectoparasite infestation. It is therefore recommended that periodic inspection and cleaning of cages should be carried out to eliminate completely the incidence of ectoparasites infestation. However, further work should be carried out to determine the effects of ectoparasites infestation on predilection sites of captive birds.

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Table 1. Checklist of Ectoparasites Infesting Captive Birds in the Jos Museum Zoological Garden

Bird	Order	Family	Ectoparasite	Order	Species	Total (%)
Bateleur Eagle	Falconiformes	Accipitridae	*	*	*	-
Black kite	Falconiformes	Accipitridae	*	*	*	-
Crown Crane	Gruiformes	Gruidae	Lice	Phthiraptera	*Philopterus fringillae*	23 (39.66)
Hawk Eagle	Falconiformes	Accipitridae	*	*	*	-
Geese	Anseriformes	Anatidae	Lice	Phthiraptera	*Columbicola bacillus*	1 (1.72)
Grey Heron	Pelecaniformes	Ardeidae	*	*	*	-
Marabou Stork	Ciconiiformes	Ciconiidae	Lice	Phthiraptera	*Ciconiphilus quadripustulatus*	9 (15.51)
			Hard tick	Parasitiformes	*Boophilus* spp	4 (6.90)
			Soft tick		*Argas* spp	1 (1.72)
Martial Eagle	Falconiformes	Accipitridae	*	*	*	-
Ostrich	Struthioniformes	Struthionidae	Lice	Phthiraptera	*Struthiolipeurus struthionis*	11 (18.97)
			Hard tick	Parasitiformes	*Boophilus* spp	4 (6.90)
Owl	Strigiformes	Strigidae	*	*	*	-
Palmnut Eagle	Accipitriformes	Accipitridae	*	*	*	-
Peacock	Galliformes	Phasianidae	Lice	Phthiraptera	*Geniodes dispar*	3 (5.17)
Wild Duck	Anseriformes	Anatidae	Lice	Phthiraptera	*Columbicola bacillus*	1 (1.72)
			Mite	Mesostigmata	*Sarcoptes* spp	1 (1.72)
Total (%)						**58 (100)**

***Ectoparasite absent**

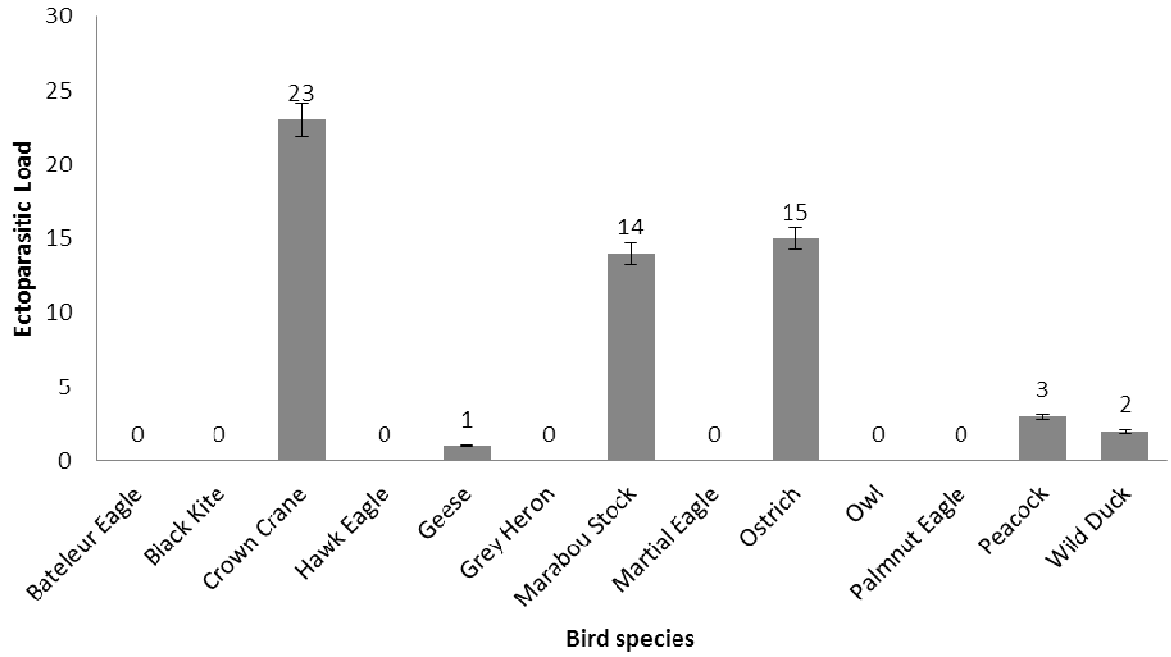

Figure 1. Prevalence Rate of Ectoparasites in relation to Captive Birds in the Jos Museum Zoological Garden

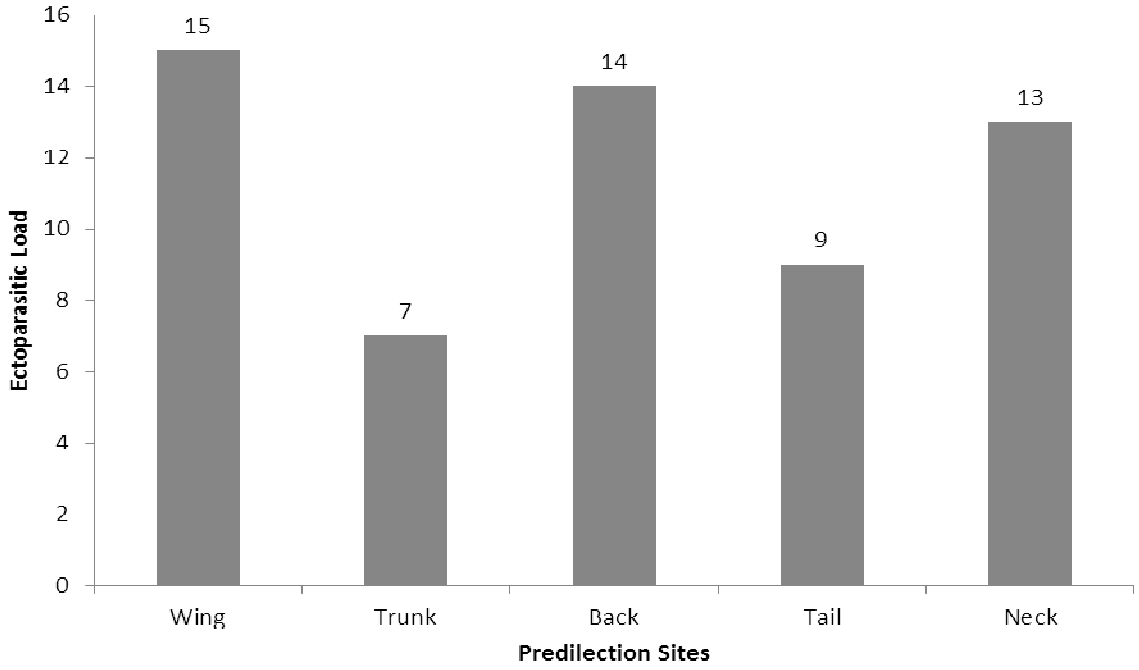

Figure 2. Ectoparasitic Load in relation to Predilection Sites

Table 2. Ectoparasitic Load in Relation to Captive Bird Species and Predilection sites

Bird	X^2	DF	P – value
Crown Crane	22.8696	4	0.001*
Geese	4	4	0.406
Marabou Stork	32.4286	4	0.001*
Ostrich	24	4	0.001*
Peacock	5.3333	4	0.255
Wild Duck	3	4	0.558

*** Significant difference**