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Survey of External Parasites of Wild Birds in Kaduna State, Nigeria

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aims: As wild birds interact with poultry the likelihood of exchange of external parasites between wild birds and poultry highlights the need to understand wild bird parasites so as to reduce cross infection at the wild bird-poultry interface. There is paucity of data on external parasites of wild birds in Kaduna State, Nigeria. This study investigated the prevalence and diversity of external parasites among wild birds in Kaduna State.
Place and Duration of Study: The study was carried out in Kaduna State, Nigeria between March, and June 2012.
Methodology: Wild birds were captured and examined for external parasites by visual and microscopic examination. The data were analyzed using Quantitative Parasitology software.
Results: Of the 233 wild birds representing 56 species and 25 families examined, the ectoparasite prevalence was 10.7% (25/233). The ectoparasites identified were *Menacanthus* spp (0.9%), *Amblyomma variegatum* (0.9%), *Argas persicus* (3.4%), *Gonides gigas* (2.1%) and *Rhipicephalus* spp (2.6%). *Streptopelia senegalensis* and *Chalcomitra senegalensis* were infested with *Amblyomma varigatum* while *Numida meleagris* and *Ploceus cucullatus* had *Rhipicephalus* spp.
Conclusion: This is the first report to the best of our knowledge of hard tick infestation of free flying birds in Kaduna State. This study establishes baseline data for future study of wild bird host-parasite interaction in Nigeria. There is need for more studies on external parasites of wild birds to understand their impact on the survival of wild bird species in Nigeria.

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1. INTRODUCTION

Wild birds are known to host a variety of parasites [1]. Parasites usually affect population growth of species as well as interactions between species with the milder endemic parasites being able to play a major role in population regulation despite occasional devastating epidemics [2,3,4]. Parasites also exhibits other ecological implications in phenomena such as parasite mediated host competition, sexual choice, social ehavior, foraging tactic and predator-prey interactions [5,6,7,8]. The ability of these parasites to affect host life history and fitness coupled with their impact on host reproduction and survival highlights their role as formidable evolutionary forces [9,10].

The importance of parasites in the ecology of wild birds is being increasingly recognized and many health and parasite surveys have been conducted on wild birds [10,11]. However, reports of studies on the ecology of WB parasites of free flying and live wild bird markets (LWBMs) wild birds in Sub Saharan Africa are scanty [11]. Consequently, because of the rich avi-fauna of Sub-Saharan Africa coupled with the fact that being home to wintering migratory birds from Europe and Asia [12], it is vital to understand the ectoparasite community in this region and its potential health effects on wild birds. This study surveyed external parasites of free flying and LWBMs wild birds in Kaduna State, Nigeria. The study also appraised variation in parasite abundance, their prevalence in host populations, and intensity of infection in different families and species of wild birds.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Kaduna State, located in North Western Nigeria between latitude $8^{o}45''$- $11^{o}30''$ North and longitude $6^{o}11''$ – 9^{o}East [13]. It shares boundary with Kastina, Kano, Plateau, Niger, Zamfara, Bauchi, Nassarawa and FCT and has 23 local government areas that are inhabited by ethnic groups including Hausa, Fulani, Kaje and Kataf amongst others. Kaduna State has a population of 6 million people [13].

The annual temperature is 34^{o}C with hottest months being March-April (40^{o}C) and the coolest period (13.2^{o}C) being December during severe harmattan. Rainfall varies between 1,000 mm and 1,500 mm and the rainy season last 100-150 days (Mid April – ending of October). The dry season occurs between October and April [13]. Kaduna State has a land structure of undulating Plateau with major rivers including River Kaduna, River Wonderful in Kafanchan, River Kagom, River Gurara and Galma [13]. The vegetation varies from the Guinea Savannah in the south to the Sudan Savannah in the North [13].

2.2 Wild Bird Sampling and Identification

Free flying wild birds were trapped using mist nets and local traps and wild bird sellers in live wild bird markets and hunters gave their consent for their birds to be sampled. Ducks and guinea fowls which are semi-domesticated birds were sampled from the Anchou LBM and from a free-range flock.

All birds were visually identified with the aid of a field guide by Borrow and Demey [14], physically examined prior to sampling. All birds sampled were marked using a permanent marker to avoid multiple sampling of the same bird. Wild birds in live wild bird markets were also sampled and their management/medical history of the LWBMs birds were recorded.

2.3 Sampling Technique

Wild bird in LWBMs, free flying and semi-domesticated birds from live poultry markets (LPMs) were sampled between February and June 2012. Four sampling locations were chosen based on poultry density, presence of LWBMs and LPMs; water bodies.

Sample size for the study was not pre-determined due to lack of information on the prevalence rate of ectoparasites and the inability to estimate the population of wild birds in Kaduna State. A targeted sampling was done.

2.4 Sampling Units

The live wild bird biosecurity assessment was undertaken using a biosecurity checklist. The biosecurity checklist was designed, pretested and adjustment was made to correct limitations identified during pretesting. The checklist was used to assess the biosecurity features present in the markets that may increase the risk of

introducing, maintaining, or spreading AI and estimated the level of risk.

2.5 External Parasite Collection

The birds were thoroughly examined for ectoparasites, and parasites seen were picked and together with feathers using a masking tape from the head, under wing, back and abdomen were placed into a sample bottle containing 70 % alcohol. The collected samples wer transported to the Entomology Laboratory of the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University for identification.

2.6 External Parasite Examination

The ectoparasites collected were examined for identification by microscopy. The ticks were identified using tick identification keys available from different sources [15,16]. Fleas, mites, flies and lice were examined under dissecting microscope and identification carried out according to guidelines described by Soulsby [17]. Parasites identified were documented by photography.

2.7 Data Analysis

Positive bird was defined as any bird testing having at least one external parasite species. Prevalence, mean intensity and mean abundance values were analysed using Quantitative Parasitology 3.0.

The differences in prevalence between external parasites, was determine using chi square test. The difference in mean intensity and abundance between parasites was determined using t-test. The median intensities were compared using Mood's median test. Confidence intervals are better than standard deviation for describing parasite distributions [18]. Confidence intervals for prevalence and intensity were computed using Sterne's exact method, and bootstrapping (with 2,000 repetitions), respectively, using the computer program Quantitative Parasitology 3.0 [19].

Prevalence between and within families, species, epidemiologic units and sampling sites, were compared by the chi-square test with p values <0.05 were considered significant. Association of external parasite were analyzed using cross-tabulations with Statistical Package for Social Sciences (SPSS) version 17.

3. RESULTS

Of the 233 birds sampled in this survey, 11.6% (27/233) were infested with at least one species of external parasite. However, 39.4% (13/33) families and 23.2% (13/56) species were infested, with prevalence within families ranging from 6.3% for Anatidae to 100% in Timaliidae.

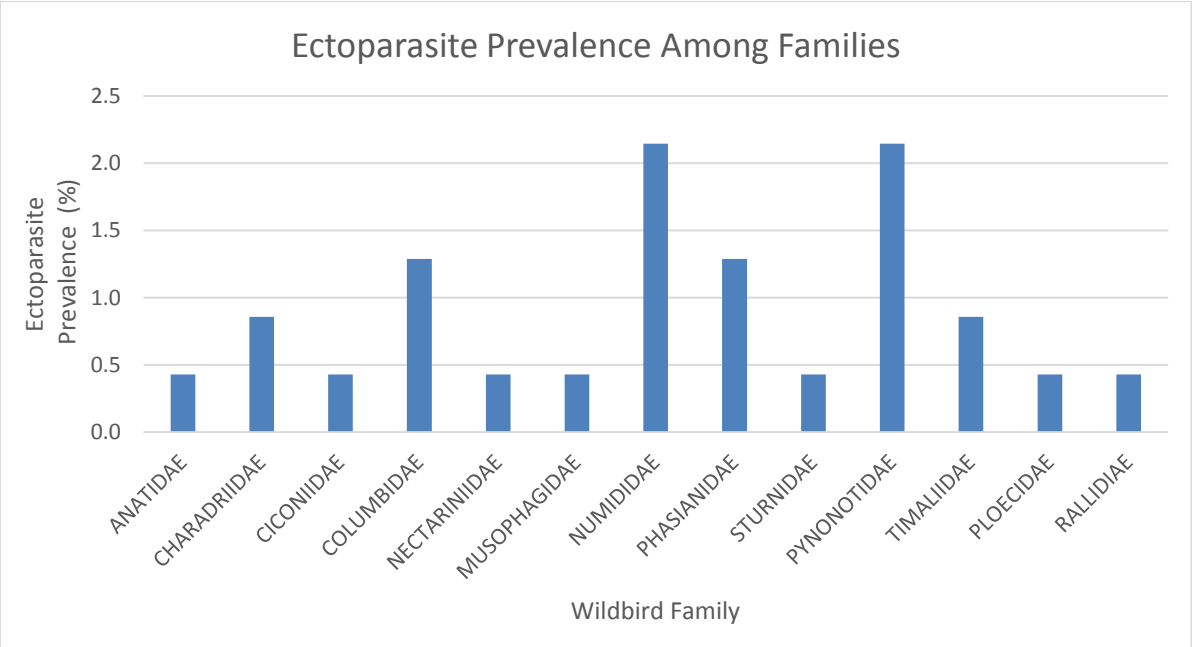

Fig. 1. Ecto-parasite prevalence among wild birds in Kaduna State, Nigeria

However, among the 13 species infested, *Dendrocygna viduata*, *Buphagus africanus*, and *Pychonotus barbatus* had the highest species prevalence rate of 100% with the lowest been *Francolinus bicalcaratus* with 8.3% (3/36) (Fig. 1).

The ectoparasites identified in the study were *Menacanthus* lice, *Amblyomma variegatum*, *Argas persicus*, *Goniodes gigas* and *Rhipecephalus spps*. *Argas persicus* larvae was the most prevalent external parasites with prevalence of 3.9% (9/233) followed by *Rhipecephalus* spps having a prevalence rate of 3.4% (8/233) and 2.6 % (6/233) respectively. *Menacanthus* spps were observed in 0.9% (2/233) of birds, followed by and Gonides gigas having prevalence rates of 2.1% (5/233). The prevalence rates among the species are represented in Fig. 2.

Fifty per cent of black headed lapwing (2/4), lesser blue-eared starling (1/2) and brown babbler (1/2); 14.3% (2/14) of common bulbul and 6.9% (2/29) of laughing dove and were infested with beetle. However, 33.3% (1/3) Squacco heron was infested with an unidentified flea with unidentified eggs were reported in 2.8% (1/36) of doubled-spurred francolin. Similarly, 7.1% (1/14) of common bulbul and 25% (1/4) of western gray plantain eater were infested with an unidentified fly (p=0.00, df=384, x^2 = 492.51).

Among the wild bird species infested with ecto-parasite, 46.1% (6/13) were infested by *Agars Persicus* with B. africanus and T. plebejus having the highest prevalence (Fig. 3).

However, only *Numida meleagris* was infested with Rhipicephalus *species* though *Amblyomma vareigatium* infested *Streptopelia senegalensis* and *Chalcomitra senegalensis* (Table 1).

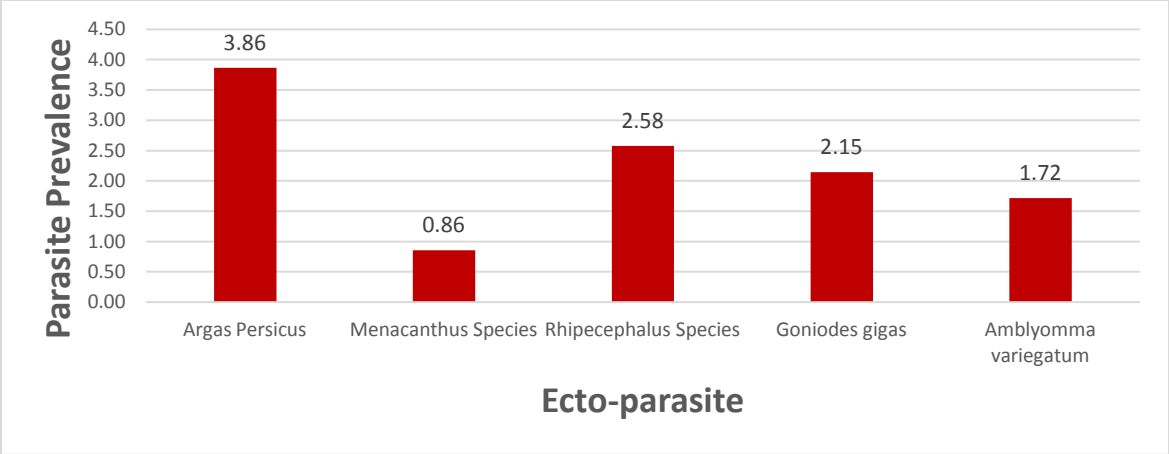

Fig. 2. Ecto-parasite prevalence among wildbirds in Kaduna State, Nigeria

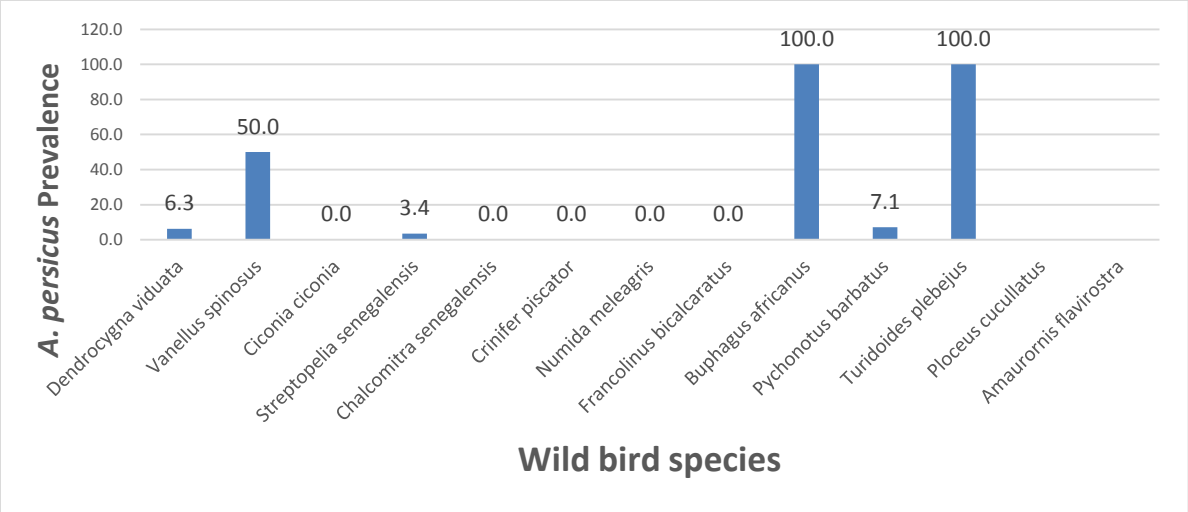

Fig. 3. Prevalence of A. percicus among wildbird species in Kaduna State, Nigeria

Table 1. Ectoparasites prevalence among wild bird species in Kaduna State, Nigeria

Infected Family/Species	P (No. infected/ sample)	*Menacanthus*	*Rhicephalus*	*Goniodes gigas*	*Amblyomma varigatum*
Vanellus spinosus	50.0% (2/4)				
Ciconia ciconia	50.0% (1/2)				
Streptopelia senegalensis	10.3% (3/29)			3.4% (1/29)	3.4 % (1/29)
Chalcomitra senegalensis	20% (1/5)				20 % (1/5)
Crinifer piscator	25.0% (1/4)	25 % (1/4)			
Numida meleagris	16.7 % (5/30))		16.7 % (5/30)		
Francolinus bicalcaratus	8.3% (3/36)			5.6% (2/36)	
Buphagus africanus	100 % (1/1)				
Pychonotus barbatus	35.7% (5/14)			7.1 % (1/14)	
Turidoides plebejus	100 % (2/2)				
Ploceus cucullatus	50.0% (1/2)	50 % (1/2)	50 % (1/2)		
Amaurornis flavirostra	14.3 % (1/7)			14.3 % (1/7)	
Overall Prevalence	11.6% (27/233)	0.9% (2/233)	2.6% (6/233)	2.15% (5/233)	2/233

Based on epidemiologic sampling units 1.1% (2/173) and 2.9 % (5/175) of free flying birds had *A. vareigatum* and G. gigas infestation though none of LBM (0/45) AND LWBM (0/13) were infested. However, 0.6 % (1/175) of free flying birds was infested with *Rhiphicephalus spps*. And none in other units. ($p=0.00$, $df= 2$, $x^2 =16.21$) with a *Menathcantus* prevalence is 1.1% (2/175) in free flying birds and 0% in LBMs and LWBMs.

Similarly, 4.6% (8/175) of free flying birds were infested with beetles, 0.6% (1/175) with an unidentified mite, eggs and insect in free flying birds. However, 7.7% (1/13) of birds in LWBM was infested with mites ($p=0.49$, $df=12$, $x^2 = 21.09$).

Based on sampling sites, Samaru had an ectoparasite prevalence rate of 13.4% (19/142) with Anchou having 7.6% (5/66); Kaduna, 6.7% (1/15), and 0% (0/5) for Koraye and Zaria. The prevalence between sites was 20% (5/25) for Anchou, 4% (1/25) for Kaduna and 76% (19/25) for Samaru.

A. Varigatium prevalence in Samaru was 1.4% (2/142) and 0% in Koraye (0/5), Kaduna (0/15) Zaria (0/5) and Anchou (0/66). A. persicus and G. gigas prevalence were 5.6% (8/142) and 3.5% (5/142) in Samaru with zero prevalence in Kaduna, Koraye, Zaria and Anchou. Rhipicephalus prevalence in Anchou was 7.6 % (5/66) and 0.7% (1/142) in Samaru.

Prevalence rates of mite and unidentified eggs in Anchou were 1.5% (1/66). The mite prevalence in Kaduna was 6.7% (1/13) while in Samaru, prevalence rates of beetle was 5.6% (8/142). However, unidentified insect and eggs were recovered from 0.7% (1/142) of birds sampled in Samaru.

4. DISCUSSION

The study confirms previous reports of external parasites infection among wild birds in Kaduna State [20]. These parasites, both singly and in combination, might be responsible for lost of resources from the birds, tissue injury, causing reduced immunity from disease and potentially decreased reproductive success of adults. However, other studies in Africa revealed a significant variation of parasite prevalence, ranging from 72% and 61.9% in Zaire and Uganda, respectively, to 39.8% in Zambia, and 11.5% in Senegal [21,22,23].

Numididiae had the highest prevalence between and within families increasing its role in the transfer of avian parasites between domestic poultry and wild birds since it is semi-domesticated and its ability to fly allows it to interact with wild birds distant from human habitation.

This study revealed that birds sharing anthropogenic habitats have higher prevalence emphasizing the success of ornithophilic vectors and susceptibility of birds around human habitats. This is likely due to abundance of vectors for these parasites since these environments would promote establishment of these vectors and maintenance of the parasites by domestic local poultry. Secondly the encroachment of human development which reduces and change wild bird habitats is a source of stress to these birds which negatively impact on their immune system thereby affecting their ability to combat infection.

The study revealed that wild birds in Kaduna State were infested with ectoparasites though the prevalence reported in this study was lower than previous report in free flying doves around Zaria and captive wild birds in Maiduguri [24,20]. Similarly, the prevalence of ectoparasites in Columbidae was low in this study. The difference in the prevalence is because captive birds are confined which might lead to cross infestation hence the higher prevalence. The ectoparasite infestation of these birds would likely to lead to discrimination of these birds as reproductive mate hence reproductive-input and contribution of these individuals' genotype in future generation is reduced [25].

Results of this study is the first evidence of hard tick infestation in free flying wild birds in Nigeria as previous studies reported mainly lice, mites and soft ticks [20,24]. However, hard ticks such as *Rhipecephalus* which infested guinea fowl in this study might have been introduced from dogs within the households. Ticks cause blood loss and can also transmit some infectious diseases [26]. Lice may irritate nerve endings and interfere with the rest and sleep of affected birds and large infestations cause feather loss, lameness, or even death [27,28].

This study revealed that free flying birds are more likely to be infested with ticks and lice than birds in LBMs or LWBMs which is contrary to reports that bird in captivity are likely to have high ectoparasite burden (25). This might be due

to regular treatment with acaricide by wild bird sellers.

Although beetle infestation of free flying birds was reported in this study, the importance of this finding is unclear though it might indicate beetle infestation of the bird's nest.

The high prevalence of ectoparasites in Samaru which is an urban area with a high anthropogenic encroachment of bird habitat has resulted in altering the bird-parasite interaction unlike Koraye where the bird habitat is almost intact. However, the pattern of ectoparasite infestation revealed in this study highlights the possibility of ectoparasite cross infection from domestic animals to wild birds.

Although the haemoparasites reported in this study require a vector, none of the ectoparasites reported are known vectors which confirms that lice, ticks and mites are not vectors of these haemoparasites. However, the unidentified fly infesting a Hemoproteus infected bird might be a Hippoboscid fly.

5. CONCLUSION

This study establishes baseline population data for future study of wild bird host-parasite interaction in Nigeria. There is need to investigate the pathogenic effects of these external parasites to understand their interaction and true impact on Nigerian bird populations with changes in wild bird habitat.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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