

Pathogenic Haemoparasites and Antibody to Newcastle Disease Virus from Apparently Healthy Wild Birds in Zaria, Nigeria

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Abstract

A total of ninety-eight wild birds, comprising eleven different species were captured alive from Zaria environs. These birds were used for the study, to determine the possible role they play as reservoirs of blood parasites. Thin blood smears (TBS) were prepared from the blood samples collected from these wild birds. The slides were stained and viewed under the microscope for the identification of blood parasites. Values of packed cell volume (PCV), haemoglobin (Hb) and total protein (TP) were also determined from the blood samples. Sera from the birds were used for the determination of haemagglutination inhibition (HI) antibody titres to Newcastle disease virus (NDV). Haemoparasites, such as *Plasmodium circumflexum*, *P. relictum*, *P. nouxi*, *Haemoproteus nisi*, *H. columbae*, and *Aegyptienella pullorum* were identified from the blood of some of the wild birds. The highest mean HI antibody titre to Newcastle disease virus (NDV) ($\log_2 9.50 \pm 0.1$) and lowest mean HI antibody titre to NDV ($\log_2 2.50 \pm 1.7$) were obtained from Senegal parrot (*Poicephalus senegalus*) and Northern red bishop (*Euplectes franciscanus*), respectively. The highest mean PCV and Hb values of $49.00 \pm 0.01\%$ and $16.30 \pm 0.1g\%$, respectively were obtained from Senegal parrot (*Poicephalus senegalus*), while the lowest mean PCV and Hb values of $36.50 \pm 8.35\%$ and $12.18 \pm 2.77g\%$, respectively were recorded from African masked weaver (*Ploceus velatus*). The highest mean TP value ($7.00 \pm 0.01g/dl$) and lowest mean TP value ($1.88 \pm 0.54g/dl$) were obtained from Laughing dove (*Streptopelia senegalensis*) and Zebra waxbill (*Sporaeoginthus subflavus*), respectively. It was concluded that wild birds could serve as reservoirs of haemoparasites and viral pathogens which could be potential dangers to domestic birds in Zaria, Nigeria.

Key words: Haemoparasites, Viral pathogens, Wild birds, Antibody, Nigeria.

Introduction

Birds are widely distributed worldwide. They are found in all the seven continents. They live and breed in most terrestrial habitats. It is believed that the highest bird diversity occurs in tropical regions of the world. It was earlier thought that high diversity was the result of higher speciation rates in the tropics (Newton, 2003; Clements, 2007). However, recent studies have found higher speciation rates in the high latitudes that were offset by greater extinction rates than in the tropics (Weir and Schluter, 2007).

Birds are the largest sources of animal protein eaten by humans. Domestic birds, such as chickens, turkeys, ducks and geese account for

much of human poultry consumption in most parts of the world (Gill, 2006; Clements, 2007).

Some species of wild birds are also of economic important, mostly as sources of food required through hunting. The species of wild birds commonly hunted for food include pheasant, wild turkeys, quails, doves, partridges, wild geese, guinea fowls and woodcocks (Keane *et al.*, 2006; Clements, 2007), while songbirds and parrots could be used as pet birds. Other commercially valuable products from birds include feathers which are used as insulation in clothing and bedding (Chamberlain *et al.*, 2005; Walther and Clayton, 2005).

Many land, shore and water birds undertake annual long distance migrations that is usually

triggered by the length of day light as well as weather conditions, thereby optimising availability of food sources and breeding habitat (Berthold *et al.*, 2001; Shaffer *et al.*, 2006; Clements, 2007). During migration, wild birds can disperse infectious agents across their migratory routes, and myriad pathogens harmful to poultry or other vertebrates have been associated with them (Dhama *et al.*, 2008). For example, wild birds have been incriminated in spreading pathogens responsible for diseases, such as psittacosis, salmonellosis, campylobacteriosis, avian tuberculosis, avian influenza, Newcastle disease *et cetera* over a long distance (Oladele *et al.*, 1999; Hubalek, 2004; Spottiswoode and Colebrook-Robjent, 2007). They can also harbour haemoparasites, such as *Plasmodium* species which can be transmitted to other birds or animals through vectors. For efficient dispersal of pathogens, therefore, wild birds could serve as reservoirs of micro-organisms or mechanical dispersers of vectors that harbour pathogens.

Because of the role of wild birds in harboring pathogens responsible for poultry diseases, it is very important that we screen their blood for haemoparasites and viral antibody that are of economic importance.

The aims of the study were to determine the presence of haemoparasites; NDV HI antibody titres; and the values of PCV, Hb and TP from the blood of some wild birds in Zaria environs.

Materials and Methods

Site of experiment: The study was carried out in Zaria, Northern Nigeria (11° 10'N; 07° 38'E). Trees and grasses characterize the vegetation of this zone with average rainfall, ranging from 1000mm to 1250mm, and temperature of 17°C to 33°C (Sa'idu *et al.*, 1994).

Experimental birds: A total of ninety-eight wild birds, belonging to eleven species were used. They include the Laughing dove (*Streptopelia senegalensis*), Northern red bishop (*Euplectes franciscus*), Zebra wax bill (*Sporaeginthus subflavus*), Village weaver (*Ploceus cycullatus*), African silver bill (*Euodice cantans*), Cut-throat finch (*Amadina fasciata*), Senegal parrot

(*Poicephalus senegalus*), African thrush (*Turdus pelios*), African masked weaver (*Ploceus velatus*), Alleys galinue (*Porphyrio alleni*) and Scally-fronted weaver (*Sporofipes fronterlis*).

The birds were captured alive with the aid of net traps which were placed at different locations in Zaria environs so as to evenly sample the birds. After the birds were captured they were taken to the Department of Biological Sciences, Ahmadu Bello University, Zaria for identification.

Clinical examination and blood sampling: After identification, the birds were examined individually for any lesions on their bodies. Each species of bird was kept in different cages and observed for three to five days before blood sampling. Millets, insects and water were provided *ad libitum*.

Blood sampling was through wing venepuncture, using 23 gauge sterile hypodermic needles and syringes. Blood for haematological parameters were collected into labeled Bijou bottles, containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant. Blood samples for serum analysis were taken without anticoagulant. The serum samples were separated by centrifugation at 1,000g for 10 minutes and stored frozen in plastic vials until laboratory determinations were carried out.

Laboratory procedures: Thin blood smear technique was carried out according to the standard procedures of Thrall (2004). The PCV, Hb and TP concentrations were determined by routine laboratory procedures of Benjamin (1985). Newcastle disease virus HI antibody quantification was performed using haemagglutination (HA) and HI procedures of Beard (1989): Two-fold dilutions of 50µl of the sera were made in phosphate buffered saline (pH 7.2), and four haemagglutination (4HA) units of LaSota virus antigen in 50µl of 1% erythrocytes suspension were added to each well of the microtitre plate and left for 45 minutes at room temperature (26–30°C). The HI titre for each serum sample was determined at the highest dilution of serum which causes complete inhibition of 4HA units.

Statistical analysis: All the data obtained were subjected to statistical analysis using Student's t-

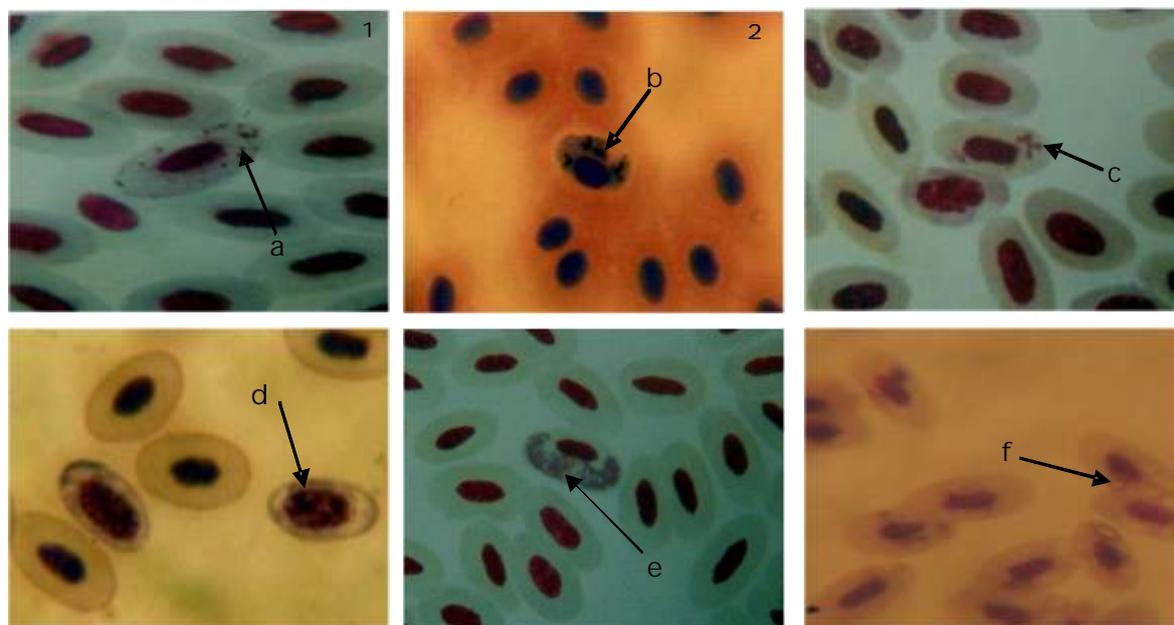


Figure-1: *Plasmodium circumflexum* (arrow head a) in the RBC of African masked weaver (*Ploceus velatus*) x 100 .
 Figure-2: *Plasmodium relictum* (arrow head b) in the RBC of Cut-throat finch (*Amadina fasciata*) x 100
 Figure-3: *Plasmodium nouxi* (arrow head c) in the RBC of Laughing dove (*Streptopelia senegalensis*) x 100 .
 Figure-4: *Haemoproteus nisid* (arrow head d) in the RBC of African silver bill (*Euodice cantans*) x 100
 Figure-5: *Haemoproteus columbae*, (arrow head e) in the RBC of Laughing dove (*Streptopelia senegalensis*) x 100 .
 Figure-6: *Aegyptianella pullorum* (arrow head f) in the RBC of Senegal fire finch (*Lagonostica senegala*) x 100 .

test analysis. Values of ($P < 0.05$) were considered significant.

Results

Senegal parrot (*Poicephalus senegalus*) has the highest NDV HI antibody titre of $\log_2 9.50 \pm 0.1$, followed by Cut-throat finch (*Amadina fasciata*) with NDV HI antibody titre of $\log_2 8.10 \pm 1.0$ and Alleys galinue (*Porphyrio alleni*) with NDV HI antibody titre of $\log_2 6.00 \pm 0.1$. The lowest NDV HI antibody titre of $\log_2 2.50 \pm 1.7$ was recorded from Northern red bishop (*Euplectes franciscanus*) (Table 1).

The highest values of PCV and Hb of $49.00 \pm 0.01\%$ and $16.30 \pm 0.1g\%$, respectively were recorded from Senegal parrot (*Poicephalus senegalus*). On the other a hand , the lowest values of PCV and Hb of $36.50 \pm 8.35\%$ and $12.18 \pm 2.77g\%$, respectively were recorded from African silver bill (*Euodice cantans*) (Table 1).

Zebra waxbill (*Sporaeiginthus subflavus*) had the lowest TP value of $1.88 \pm 0.5g/dl$, while the highest TP value of $7.00 \pm 0.01g/dl$ was

recorded from Laughing dove (*Streptopelia senegalensis*) (Table 1).

Discussion

In this study, *P. circumflexum*, *P. relicum* and *P. nouxi* were found in the blood of some of the wild birds sampled. It has been established that *Plasmodium circumflexum* and *P. relicum* which infect primarily the passerine birds can also infect domestic fowls or be experimentally transmitted to them; and the pathologic effects of these organisms in avian hosts range from no apparent signs to severe anaemia and death (Bennett *et al.*, 1974; Springer, 1997; Valkiu-Nas, 2005).

The birds harbouring these blood parasites in this study were apparently healthy without any sign of anaemia. This is evidenced by mean range of PCV of $36.50 \pm 8.35\% - 49.00 \pm 0.01\%$; and mean range of Hb of $12.18 \pm 2.77 g\% - 16.30 \pm 0.1 g\%$. The values of these blood parameters were within the established normal values for both wild and domestic birds (Balash *et al.*, 1973;

Table-1. Mean values of packed cell volume, haemoglobin, total protein and Newcastle disease virus antibody titre of different species of wild birds in Zaria (Mean \pm SE)

Species of wild birds	n-value	PCV	Haematological parameters		
			Hb (g/L)	TP (g/L)	HI (log ₂)
Cut-throat finch (<i>Amadina fasciata</i>)	10	47.86 \pm 6.39	15.96 \pm 2.12	2.26 \pm 0.43	8.10 \pm 1.0
Laughing dove (<i>Streptopelia senegalensis</i>)	10	41.00 \pm 11.75	13.68 \pm 3.92	7.00 \pm 0.01	5.70 \pm 0.5
African masked weaver (<i>Ploceus velatus</i>)	10	36.50 \pm 8.35	12.18 \pm 2.77	6.88 \pm 0.09	-
African silver bill (<i>Eudice cantans</i>)	10	43.00 \pm 10.58	14.33 \pm 3.50	4.00 \pm 2.65	-
Northern red bishop (<i>Euplectes franciscanus</i>)	8	39.50 \pm 4.95	13.15 \pm 1.63	2.50 \pm 0.71	2.50 \pm 1.7
African thrush (<i>Turdus pelios</i>)	8	44.50 \pm 0.71	14.85 \pm 0.21	2.20 \pm 0.28	-
Senegal parrot (<i>Poicephalus senegalus</i>)	10	49.00 \pm 0.01	16.30 \pm 0.1	3.30 \pm 0.42	9.50 \pm 0.1
Village weaver (<i>Ploceus cycullatus</i>)	10	42.71 \pm 4.19	14.36 \pm 1.45	4.16 \pm 2.09	-
Zebra waxbill (<i>Sporaeoginthus subflavus</i>)	7	40.25 \pm 12.28	13.43 \pm 4.07	1.88 \pm 0.54	-
Alleys galinue (<i>Porphyrio alleni</i>)	9	43.00 \pm 0.1	14.30 \pm 0.2	4.70 \pm 1.1	6.00 \pm 0.1
Scally-fronted weaver (<i>Sporotipes fronterlis</i>)	6	48.00 \pm 0.1	16.00 \pm 0.2	6.40 \pm 0.3	3.50 \pm 2.5

Campbell and Coles, 1986; Thrall, 2004; Oladele, 2009).

In this study, *Haemoproteus nisi* and *H. columbae* were found in the blood of some of wild birds sampled. However, clinical signs and pathological changes associated with haemoproteus infections, such as severe lameness, diarrhoea, severe depression, emaciation, anorexia, dyspnoea, sudden death, haemorrhages on the heart, oedematous lung, swollen firm livers, spleen and kidneys (Julian and Galt, 1980; Atkison and Forrester, 1987; Springer, 1997) were not observed in the wild birds studied in this experiment.

Newcastle disease (ND) is a dreaded disease of birds. It causes great losses in poultry industry due to high morbidity and mortality rates (Oladele *et al.*, 2008; Ibu *et al.*, 2009). It is believed that HI antibodies titre of greater than log₂ 4.00 in the sera of birds that are not vaccinated can cause the disease (Allan *et al.*, 1978). It is interesting to note that in this study, some of the wild birds sampled, such as Laughing dove (*Streptopelia senegalensis*), Alleys galinue (*Porphyrio alleni*), Cut-throat finch (*Amadina fasciata*) and Senegal parrot (*Poicephalus senegalus*) had mean HI antibody titres of log₂ 5.71 \pm 0.5, log₂ 6.00 \pm 0.1, log₂ 8.10 \pm 1.0 and log₂ 9.50 \pm 0.1, respectively without showing any clinical signs or pathological changes associated with ND. Therefore, these species of wild birds could be sources of infection of NDV to domestic birds.

Since these wild birds sampled harboured these parasites without any obvious clinical or

pathological changes, they could serve as reservoirs of avian malarial parasites, haemoproteid species and NDV, and consequently, these parasites could be transmitted by vectors or through contact to domestic birds, especially rural poultry, which constitute over 60% of total poultry population in Nigeria (Garba, 2008). The rural poultry are reared under free-range or backyard management system. Their movement is uncontrolled with little or no shelter, disease prophylaxis or veterinary care, thereby constantly exposing them to contact with wild birds and their waste products in their environment (Oladele and Ayo, 1999; Reed *et al.*, 2003; Valkiu-Nas, 2005).

In conclusion, wild birds could serve as reservoirs of hemoparasites and viral pathogens that could be potential dangers to domestic birds in Zaria, Nigeria.

Conflict of interest

Authors declare that they have no conflict of interest.

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