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ORIGINAL ARTICLE

Parasites of African Mourning Dove (*Streptopelia decipiens*) and the associated Haematological and Biochemical Changes in Nigeria

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SUMMARY
The African Mourning Dove (*Streptopelia decipiens*), also called the Mourning Collared Dove is a pigeon that is predominantly distributed in Sub-Sahara Africa. Their interaction with man and other domestic and wild birds portends it as a potential carrier of zoonotic parasites but there is paucity of information on the parasites and haemato-biochemical profile of African mourning dove. This study therefore investigated the incidence, prevalence and identification of parasites of African mourning dove, and also evaluated the associated haematology and biochemical profiles. A total of 30 individuals of *Streptopelia decipiens* were purchased at Bode market in Ibadan from the stock of birds that were sourced from the Northern part of the country. Brush was used to scour the body of each bird to collect ectoparasites over a plain white-coloured paper while the contents of some sections of the gastro- intestinal tracts like crop, trachea, caecum and ileum were examined for endoparasites using the sedimentation method. Blood samples of the birds were also analysed for haemoparasites, haematological and serum biochemistry parameters. About 76.67% of the birds were positive for different parasites: endoparasites [*Capillaria* species (33.33%), *Ascaridia* species (26.67%), *Raillietina* species (6.67%), *Eimeria* species (3.33%), Davainea species (3.33%) and *Amoebataeneaspesies* (3.33%)] were found in 15(50%) of the samples while 16(64%) were positive for various haemoparasites (Plasmodium, 40%; Leucocytozoon, 24% and haemoproteus, 20%). No ectoparasites were found in the sampled birds. There were no significant differences in the haematological and serum biochemical parameters of the parasite groups except for cholesterol. This study documented different parasites associated with African mourning dove and the effect of these parasites on haematological and serum biochemistry parameters. There is need for more research work on the pathogens and diseases of African mourning dove.

Key words: Cattle, Osun State, Parasitic Diseases, Occurrence.

INTRODUCTION
Pigeons (domestic) live alongside with humans and other species in nature. They are bred as sources of food, hobby, symbol (peace) and for experimental purposes (Cooper, 1984; Harlin, 1994). Pigeons (domestic) are some of the most common birds that have adapted to life in the city and

seem to be everywhere in urban environment. Unfortunately, bird lovers of the world feed them and they have developed a dependence upon people (Bahrami *et al.,* 2013). They play a role in spreading some zoonoses to people as well as being reservoirs of many parasitic diseases of poultry (Kaminjolo *et al.,* 1988; Piasecki, 2006). Various parasites affect the growth of pigeons, their development and productivity and at times, results in death. According to American White Dove Release Association, pigeons are known to habour roundworms, hair worms, stomach wall worms, gape worms and tapeworms and these worm infections can cause droopiness, weight loss, diarrhoea and breathing problems in birds. Pigeons and doves were used as messengers during war times and are sometimes kept as pets (Baptista *et al.*, 1992; Lack, 2003). The African Mourning Dove (*Streptopelia decipiens*), also called the Mourning Collared Dove is found in Sub-Saharan Africa excluding the lowland forest of West Africa (Wells and Wells, 2001) and mostly found in the Northern part of Nigeria. Despite its name, it is not a close relative of the North American Mourning Dove (*Zenaida macroura*) (Wells and Wells, 2001).

The African mourning dove is one of the most widely distributed birds in Africa. Some of this species of animals have been domesticated for food and eggs and are eaten by people. Due to the fact that they feed on seeds and fruits, they can help in the dispersal of seeds. Doves generally, often represent some aspect of the divine, and its use has been shared, adapted and reinterpreted across cultures and millennia to suit changing belief systems (Baptista *et al.*, 1992). Because they feed on cultivated grains, they are often thought of as crop pests. They are also pests in urban areas where they nest in man-made structures and their droppings can be a nuisance. They are also known to serve as hosts to a number of parasites and carries of zoonotic diseases (Baptista *et al.*, 1992; Lack, 2003). Their interaction with man and other domestic and wild birds portends them as potential carriers of zoonotic parasites (Adang *et al., 2008*). The unhygienic environment may be sources of infestation and infection with ecto- and endo-parasites in African Mourning Dove. Various parasites affect their growth, development and productivity.

Over the years, different scientific investigations have been carried out on the parasitic profile of wild birds (Murata, 2002; Adang *et al.*, 2008; Edosomwan and Ogbonnia, 2014; Omonona *et al.*, 2014). The myriads of parasite species have been identified from free-range birds and the need to evaluate parasitism in African Mourning dove is thus imperative (Permin *et al.*, 2006). Little or no information on the parasitic and haemato-biochemical evaluation of African Mourning dove exist. Therefore this study was carried out to establish the prevalence and significance of gastrointestinal and blood parasites, haematological and biochemical profiles of African Mourning dove in Nigeria

MATERIALS AND METHODS

Study Area

The study was conducted at Ibadan. Ibadan is the largest city in West Africa and the second largest in Africa with an estimated population of over 2,550,593 million, growing rapidly with industries and residential houses. Ibadan city lies on the longitude 3°5' East of Greenwich meridian and latitude 7°23' North of the Equator (Filani *et al*., 1994).

Collection of Birds and Sample Size

A total of 30 pigeons (*Streptopelia decipiens)* were purchased from Bode market, Molete, Ibadan, Oyo State, Nigeria in the months of October and November. The birds were in apparently healthy state, quite active and acclimatized for about five

days before the commencement of laboratory studies.

Collection, Examination and Identification of Ectoparasites

Screening for ectoparasites involved a thorough examination of the body of the birds including the head, cloacal, brachial, ventral, and femoral areas.The birds were examined for ectoparasites using bristle brushes. Those with parasites were identified and recorded. Also, samples of the observed parasites were removed with a thumb forceps or camel hair brush and transferred to a Petri dish containing 10% farmol saline. They were cleared with lactophenol and fixed on a microscopic slide using a little quantity of polyvinyl alcohol and lactophenol solution before detailed morphological examination and identification using a compound microscope (Lapage, 1962; Soulsby, 1982).

Blood Sample Collection and Analysis

Blood samples (1 mL) were collected from the wing venipuncture into Ethylenediaminetetraacetic acid (EDTA) bottle. The blood samples were rocked carefully with the anticoagulant, making the blood to dissolve the dried lithium, thereby, preventing clotting. The sample bottles were then taken to the laboratory and processed immediately for haematological analyses. Haematological parameters such as packed cell volume (PCV), haemoglobin concentration (Hb) and red blood cell (RBC) counts were determined using standard techniques described by Coles (1986) and Omonona and Emikpe (2011). Differential leucocyte counts were determined by microscopic examination of Giemsa stained blood smear (Jain 1986). The biochemical parameters (Total protein, Albumin, ALT, AST, BUN, Creatinine, Cholesterol, Glucose, Sodium and Chloride) were determined using the haemocytometric method as described by Bartley (2001). The Globulin value was determined from the difference of the total protein and the albumin values.The Albumin:Globulin (A:G) ratio was determined from the albumin and globulin concentrations as described by Lumeij, (2000).

Haemoparasites: A drop of blood and buffy coat was placed on a grease free glass slide and a thin blood smear was made from each blood sample, air-dried, fixed in methanol for 2-3 minutes, stained in Romanowsky stain and rinsed in Phosphate buffered saline according to Jain (1986). The smears were examined at X100 magnification (oil immersion) on an Olympus binocular Microscope.

Gastrointestinal Tract (GIT) Parasites: The birds were euthanized using cervical dislocation and the gastrointestinal tracts (duodenum, caecum, ileum, crop), and trachea were opened and the contents was collected. Adult worms were recovered from the contents and identified morphologically under a stereo microscope. The contents of each segment was also examined using the sedimentation method according to Then point *et al.* (1979) and Khin-Khin, (2007) for the presence of helminthes ova and protozoan oocysts.

Statistical Analysis

The descriptive analysis of the haematological parameters was expressed using mean as a measure of central dispersion and the parasite prevalence was calculated in percentage. The data was analyzed using SPSS v20 statistical package for comparison of the mean using One-Way ANOVA and significant differences were set at $\alpha_{0.05}$.

Table I: Prevalence of the GIT parasites and haemoprotozoans in African Mourning dove (*Streptopelia decipiens*)

Species	Number of samples	Prevalence (%)
GIT parasites	15	50
Capillaria species	10	33.33
Ascaridia species	8	26.67
Raillietina species	2	6.67
Davainea species	1	3.33
Amoebataenia species	1	3.33
Eimeria species	1	3.33
Haemoparasites	16	64
Plasmodium species	10	40
Haemoproteus species	6	24
Leucocytozoon species	6	24

Table II: Co-infection of parasites in African mourning dove (*Streptopelia decipiens*)

Parasite type	Prevalence (%)
GIT parasites	23.33
Haemoparasites	32
GIT parasites and Haemoparasites	23.33

Table III: Mean Value of Haematological Parameters

PCV	Hb	RBC	WBC	Platelets	Lym	Het	Mn	Eos.	Bas.	MCV	MCHC	MCH
38.44 ± 8.35	13.86 ± 6.09	3.13 ± 0.64	16328 ± 4404.6	236080 ± 36375.3	46.08 ± 10.05	47.28 ± 10.91	3.32 ± 1.60	3.28 ± 1.62	0.28 ± 0.54	124.09 ± 17.98	33.33 ± 0.76	43.88 ± 11.99

Packed Cell Volume – PCV (%), Haemoglobin Concentration – Hb (g/dl), Red Blood Cell ($\times 10^3/\mu L$) – RBC, White Blood Cell ($\times 10^3/\mu L$)– WBC, Platelet Count ($\times 10^5/\ \mu L$), Lymphocytes ($\times 10^3/\mu L$)– Lym, Heterophils ($\times 10^3/\mu L$)– Het, Monocytes ($\times 10^3/\mu L$)– Mn, Eosinophils ($\times 10^3/\mu L$) – Eos, Mean Cell Volume – MCV (fl), Mean Cell Haemoglobin Concentration – MCHC (pg)

RESULTS

Parasite Infestation and Infection

Table I shows that out of the thirty African Mourning doves used in this study, 15 (50%) were positive for various gastrointestinal parasites, including worms and eggs of *Capillaria species* (33.33%) (Plate 1), *Ascaridia species* (26.67%) (Plate 2), *Raillietina* species (6.67%) (Plate 4), *Davanea* species (3.33%) (Plate 5), *Amoebataenia* species (3.33%) (Plate 3) and *Eimeria* species (3.33%) (Plate 6). Out of the 30 birds, blood samples were collected from 25 in which 16 (64%) were positive for various haemoparasites (Table I). Species of haemoparasites observed were *Plasmodium* species (40%), *Haemoproteus* species (24%) and *Leucocytozoon* species (24%). None of the sampled birds had ectoparasites. About 76.67% of the birds were positive to at least one of the parasites observed. As shown in Table I, there was a higher prevalence of haemoparasites when compared to gastrointestinal (GIT) parasites. Table II shows that 23.33% of the birds were infected with both gastrointestinal and haemoparasites. The mean of the haematological values of the infected birds were not significantly ($p>0.05$) different from the values of the uninfected birds (Tables III and IV). Similarly the mean

Table IV: Haematological parameters along the different parasite groups

Haematological Parameter	GIT and haemoparasites	Gastrointestinal parasites	Haemoparasites	No parasite
PCV	43.33±5.86	36.5±4.95	36.69±7.24	40.14±11.64
H.B	14.4±1.73	12.25±1.77	12.15±2.41	17.26±10.69
RBC	3.12±0.59	2.94±0.65	3.11±0.64	3.23±0.77
WBC	14.73±3.14	18.83±12.48	16.92±4.16	15.19±2.85
Platelets	2.42±0.46	2.29±0.28	2.39±0.40	2.30±0.35
Eosophils	3.33±1.53	2.5±0.71	3.0±1.22	4.0±2.38
Lymphocytes	38.0±7.81	48.5±13.44	46.85±10.94	47.43±8.75
Heterophil	56.0±7.94	46.5±9.19	46.23±12.38	45.71±9.53
Monocytes	2.67±1.15	2.0±2.83	3.85±1.77	3.0±0.82
Basophils	0.0±0.0	0.5±0.71	0.31±0.48	0.29±0.76
MCV	140.56±18.76	125.36±10.90	119.84±17.44	124.58±19.26
MCHC	33.28±0.94	33.54±0.30	33.14±0.82	33.66±0.67
MHC	46.89±7.49	42.03±3.28	44.55±15.89	41.89±6.20

Packed Cell Volume – PCV (%), Haemoglobin Concentration – Hb (g/dl), Red Blood Cell ($\times10^3$/µL) – RBC, White Blood Cell ($\times10^3$/µL)– WBC, Platelet Count ($\times10^5$/ µL)– Plate, Lymphocytes ($\times10^3$/µL)– Lym, Heterophils ($\times10^3$/µL)– Het, Monocytes ($\times10^3$/µL), Eosinophils ($\times10^3$/µL) – Eos, Mean Cell Volume – MCV (fl), Mean Cell Haemoglobin Concentration – MCHC (pg)

Table V: Mean Value of Serum Biochemistry Parameters

Protein	Albumin	Globulin	A:G Ratio	AST	ALT	ALP	Creat	BUN	Gluco	Choles	Sodium	Chlor
8.78 ± 0.77	3.78 ± 0.42	5.03 ± 0.47	0.71 ± 0.08	199 ± 30.94	31.88 ± 8.84	218.32 ± 50.01	0.95 ± 0.19	11.00 ± 0.90	245.72 ± 90.34	167.64 ± 39.39	131.76 ± 9.85	107.90 ± 21.50

A:G Ratio – Albumin:Globulin ratio, AST – Aspartate aminotransferase, ALP – Alkaline phosphatase, ALT– Alanine aminotransferase. Choles- Cholesterol, Creat- Creatinine, Gluco- Glusose, Chlor- Chloride

serum biochemistry values of the infected birds were not significantly ($p>0.05$) different from the uninfected birds (Table V and VI).

DISCUSSION

The high incidence of haemoparasites accounting for 64% and gastrointestinal parasites (50%) in African Mourning Dove (*Streptopelia decipiens*) in this study could be due to high prevalence of insect or tick transmitting vector, although no ectoparasite was observed. The prevalence of *Ascaridia* species (26.67%) is lower than the prevalence (76.66%) reported in captive wild pigeons at Nagpur in Pakistan

(Borghare*et al.*, 2009). However, Ademola and Fagbohun (2005) reported a higher incidence of *Ascaridia columbae* (65%) and *Raillietina* species (91%) in domestic pigeon (*Columbia livia*) in Ibadan. The African Mourning Dove could be more resistant to these helminthes than to Pigeons.

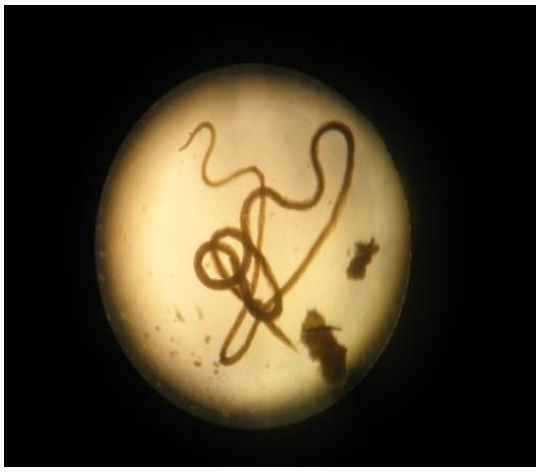

Plate 1: Helminth parasite (*Capillaria species*) Mag ×100

Plate 2: Helminth parasite (*Ascaridia species*) Mag ×100

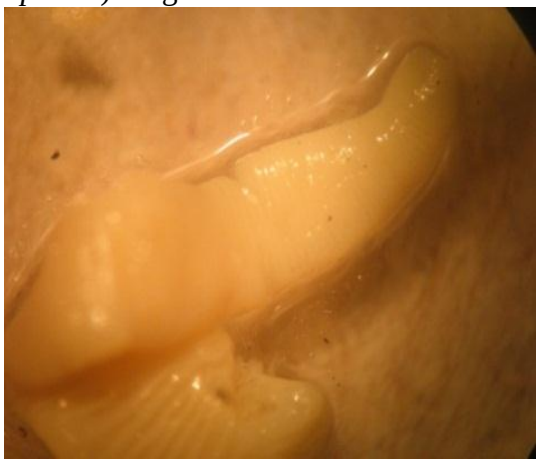

Plate 3: Helminth parasite (*Amoebataenia species*) Mag ×100

Plate 4: Helminth parasite (*Raillietina species*) Mag ×100

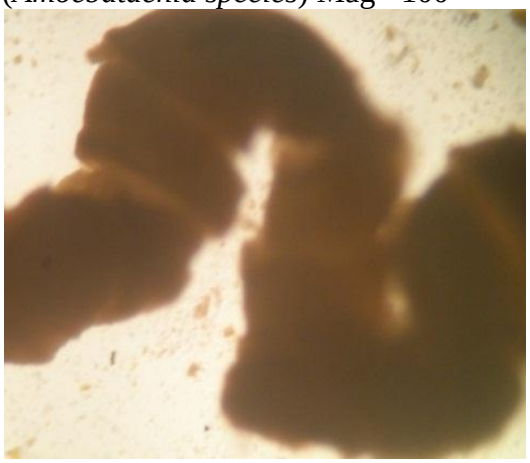

Plate 5: Helminth parasite (*Davanea species*) Mag ×100

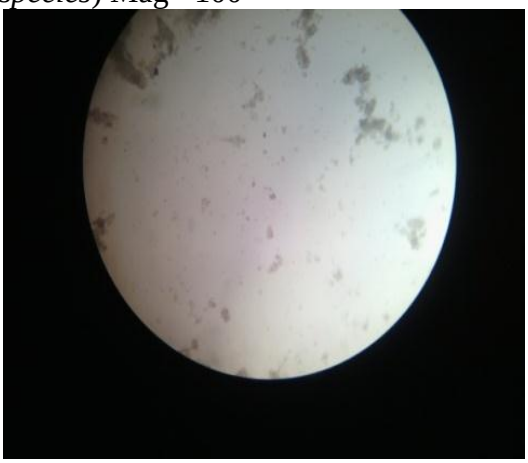

Plate 6: Oocyst of *Eimeria species*) Mag ×100

Table VI: Serum Biochemistry parameters along the different parasite groups

Biochemical Parameter	Endo and Haemoparasites	Endoparasites	Haemoparasites	No parasite
Total Protein	8.76	8.90	8.99	8.40
Albumin	3.84	3.85	3.85	3.50
Globulin	4.93	5.18	5.14	4.90
A:G Ratio	0.75	0.73	0.70	0.64
AST	196.50	189.75	193.75	218.80
ALT	196.50	189.75	193.75	218.80
ALP	246.50	217.50	199.25	204.40
Creatinine	0.95	0.95	1.01	0.84
BUN	11.18	11.25	10.82	10.62
Glucose	230.88	195.50	295.25	211.26
Cholesterol	145.63	171.50	153.88	225.80
Sodium	131.13	134.50	130.00	125.00
Chloride	112.00	111.25	110.50	112.00

A:G ratio – Albumin:Globulin ratio, AST – Aspartate aminotransferase, ALP – Alkaline phosphatase, ALT –Alanine aminotransferase

It is also possible that pigeons have more access to earthworm, which serves as transport host. Transport host such as earthworms are thought to play a role in transmission of *Ascaridia galli* and most especially in galliformes tends to have a higher risk of infection (Ramadan and Znada, 1992; Anderson, 2000). The incidence of *Raillietina* species (6.67%) and *Eimeria* species (3.33%) was lower when compared to those reported (in South Khorasan, Iran) in domestic pigeons (32.35%) and (40.19%) respectively (Radfar, 2011). The high prevalence of *Plasmodium* (40%) and *Leucocytozoon* (24%) parasites observed in this study is higher than those reported by Akinpelu, 2008 who reported (12.1%) and (10%) respectively in Red-eyed dove (*Streptopelia semitorquata*) that were sampled in Shasha forest reserve, Ile ife, Nigeria. It is known that animals in captivity are more exposed to infection due to overcrowding and cage fatigue. It could also be as a result of abundance of the transmitting vectors. The prevalence of *Haemoproteus* in African mourning dove (24%) was lower compared to those found in domestic pigeons (*Columba livia*) (76.5%) in Uganda by Dranzoa *et al.* (2010). Vector abundance and nutrition could be responsible for the difference. The haematological and serum biochemical parameters of the African mourning dove in this study did not differ significantly with the parasitic infections

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