FULL LENGTH RESEARCH ARTICLE

GASTROINTESTINAL HELMINTHS OF THE DOMESTIC PIGEONS (*Columba livia domestica* GMELIN, 1789 AVES:COLUMBIDAE) IN ZARIA, NORTHERN NIGERIA.

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ABSTRACT

The gastro-intestinal tracts of 240 *Columba livia domestica* were examined parasitologically for helminths aimed at providing information on their species composition, prevalence and distribution in Zaria area, northern Nigeria. Of these, 116 (48.3%) were infected by 9 species of helminths, comprising 6 species of cestodes and 3 species of nematodes. The infection with cestode species was in the order *Raillietina tetragona* 65 (27.1%), *R. echinobothrida* 26 (10.6%), *Hymenolepis cantaniana* 4 (1.7%), *Hymenolepis carioca* 3 (1.3%), *R. cesticillus* 1 (0.45%), and *Amoebotaenia cuneata* 2 (0.83%). *Raillietina tetragona* was the most prevalent cestodes recovered throughout the 12 months of the survey period. The three nematodes encountered were *Ascaridia columbae* 27 (11.3%), *A. galli* 8 (3.3%) and *Heterakis gallinarum* 8 (3.3%). *Ascaridia columbae* which was the most prevalent nematode was recovered in 9 out of the 12 months of the year. Single infection was more common (37.5%) than double 24 (10%) and triple infections (0.83%). More infection was observed during the wet season (June and September).

Keywords: Helminths, Prevalence, Domestic Pigeon, *Columba livia domestica,* Zaria, Nigeria.

INTRODUCTION

Columb alivia domestica Gmelin,1789 is a domesticated Columbid species widely sold or traded in Nigerian markets to augment income. It is a species of culinary interest and has become common at barbecue spots in Zaria, Nigeria.

Pigeons feed on a wide range of food items, which include grains, slugs, earthworm and insects (Adang 1999) which in many instances may carry infective stages of helminths (Soulsby 1982). Several helminths have been implicated in causing morbidity and mortality in Domestic Pigeons (Cheng 1973; Soulsby 1982) and are considered as the greatest impediments to profitable pigeon production in Nigeria (Galloway 1972). Helminth infections may have particularly deleterious or debilitating effects on infected birds, especially the young birds (squabs), causing retarding growth and interfering with healthy development, and making older birds prone to secondary infections (Cheng 1973).

The presence of nematodes in some organs (liver, trachea and lungs) of infected pigeons (Michel 1974) may portend grave public health consequences, especially when improperly barbecued pigeons are consumed. There is also the possibility that Domestic Pigeons may serve as alternative hosts for some helminths of poultry with which they interact and closely related phylogenetically.

Available information on parasites of Domestic Pigeons in Nigeria include the study by Dede & Richards (1998) in the north Eastern part, Ademola & Fagbohun (2005) in Ibadan (south West), Audu *et al.* (2004) in Zaria (north Central) and Atsineka & Banke (2006) in Makurdi (Central/Middle belt). Compared to the available literature on other poultry species in Nigeria, this information is scanty. Since the knowledge of the parasites is essential for management purposes and in the developing control measures towards improved public health, the present study investigated the species composition, prevalence and distribution of helminths in the gut of *C. l. domestica* in the Zaria area of northern Nigeria.

MATERIALS AND METHODS

240 *C. l. domestica* were purchased from Samaru and Sabon-Gari markets in Zaria (11' 03ºN, 07' 42ºE) within the northern Guinea Savanna and examined parasitologically for gastro-intestinal parasites. The birds were humanely killed, dissected and necropsied (Fatihu *et al.* 1991; Soulsby 1982 The digestive tract was removed intact and the various sections (oesophagus, crop, proventriculus, gizzard, duodenum, jejunum, ileum, caeca and rectum) separated and placed into petri dishes containing 0.9% physiological saline. Each section was cut longitudinally to expose its content (Fatihu *et al.* 1991) and then examined under a dissecting microscope. The horny layer of the gizzard was peeled off to expose embedded parasites. Parasitic nodules were teased gently to dislodge embedded parasites.

Helminths from each section were isolated, counted and preserved in specimen bottle containing 5% Formalin before identification. Parasites were identified using texts of Cheng (1973), Soulsby (1982), Ruff (1984) and Ruprah *et al.* (1986). Confirmatory identification was carried out at the helminthology laboratory of the Department of Veterinary Parasitology and Entomology, Ahmadu Bello University, Zaria, Nigeria. Prevalence, intensity and mean intensity were applied as defined by Margolis *et al.* (1982). Chi-square test was employed to

determine possible association in parasite prevalence between sexes and seasons.

RESULTS

Out of the 240 birds examined, 116 (48.3%) were infected by 9 species of gastro-intestinal helminthes comprising 6 species of cestodes and 3 species of nematodes. The species of cestodes encountered include *Raillietina tetragona* Molin, 1858 65 (27.1%); *R. echinobothrida* Megnin, 1881 26 (10.6%); *Hymenolepis cantaniana* Polonio, 1860 4 (1.7%); *H. carioca* Magalhaes, 1898 3 (1.3%); *R. cesticillus* Molin, 1858 1 (0.45%) and *Amoebotaenia cuneata* Linstow, 1872 2 (0.83%) while the nematodes were *Ascaridia columbae* Gmelin, 1790 27 (11.3%); *A. galli* Schrank, 1788 8 (3.3%) and *Heterakis gallinarum* Schrank, 1788 8 (3.3%) (Table1). The predilection site for the cestodes was the small intestine (duodenum, ileum) while the nematodes were found in the small intestine (duodenum, ileum) and also caeca (Table1).

The birds had higher prevalence of single infection (37.5%) compared to double (10.0%) and triple infections (0.8%) (Table 2). The differences in the prevalence of single, double and triple infections were significant (P<0.05).

More male birds were infected 68 (53.5%) than females 48 (46.9%) but the difference was not significant (P>0.05) (Table 3). The overall prevalence was higher in the wet season (65%) than in the dry season (31.7%) and the difference was statistically significant (P<0.05).

R. tetragona was the most common cestode encountered, occurring in 11 of the 12 months of the year, with highest prevalence of 55% in June and August. *A. columbae* which was the most prevalent nematode was recovered in nine months of the year with highest prevalence (20%) in April, August and September. Other nematodes species were *Ascaridia galli* and *Heterakis gallinarum* recovered in only 3 and 5 months of the year respectively.

TABLE 1: PREVALENCE AND PREDILECTION SITES OF HELMINTHS OF *Columba livia domestica* IN ZARIA, NIGERIA (n=240)

Site of recovery	Parasite	No birds infested	Prevalence (%)	No helminth parasites (%)	Mean intensity±SE	Range
Duodenum	*Amoebotaenia cuneata*	2	0.83	11(0.6)	5.5±2.53	3-8
	Hymenolepis cantaniana	4	1.7	24(1.4)	6.0±1.95	2-11
	Hymenolepis carioca	3	1.3	35(2.0)	11.7±2.53	8-24
Ileum	*Raillietina cesticillus*	1	0.45	1(0.05)	1.0±0.00	1-1
Duodenum/ileum	*Raillietina tetragona*	65	27.1	1145 (64.5)	17.6±5.07	2-61
	Raillietina echinobothrida	26	10.6	179(10.1)	6.9 ±1.02	2.21
	Ascaridia columbae	27	11.3	285(19.9)	10.6±2.75	1-54
	Ascaridia galli	8	3.3	76(4.3)	9.5±4.68	2-41
Caeca	*Heterakis gallinarum*	8	*3.3*	22(1.2)	2.8±0.45	1-4
Total		**116**	**48.3**	**1778**	**15.4±1.01**	**1-61**

DISCUSSION

Animals kept under intensive management and or domestication should have an extremely low or zero pararasite tolerance with proper hygiene and good management (Atsineka & Banke 2006). High parasitic infections may therefore be an indication of poor management and control efforts in either the animal or in the immediate environment where infection or re-infection (directly or indirectly) may emanate. The prevalence of 48.3% helminthic infections recorded in this study is considered high, even though it is comparable to the 43.4% reported in domestic pigeon in the same area (Audu *et al*. 2004). Alarming rates of 66.7% and 69.2% have been reported (Dede & Richards 1998; Oniye *et al.* 2000) in both wild and domestic pigeons in north-East zone of Nigeria and the Zaria area. The high prevalence of helminth infection recorded in this study could be an indication of a high incidence of the infective stages and intermediate hosts of the parasites in places where these pigeons are reared. The intermediate hosts of these parasites; beetles, pill bugs, ants, earthworms and snails which form part of the diet of pigeons (Adang 1999) are abundant and may easily infect the birds via their diet since they travel long distances in search of food.

The higher prevalence of cestodes recorded in this study is similar to earlier reports (Dede & Richards 1998; Oniye *et al.* 2000; Audu *et al.* 2004; Atsineka & Banke 2006). *Raillietina* spp., which are the dominant parasites in this study are considered as cosmopolitan, and contributes to nutrient depletion in birds (Cheng 1973).

The invertebrate hosts and or vectors for the cysticercoids of *Raillietina* spp. are ants of the genera *Pheidole* and *Tetramorium* (Soulsby 1982). Of the six species of cestodes recovered from the pigeons, *R. echinobothrida* is the most pathogenic. Intestinal nodules at the site of attachment of this parasite caused hyperplastic enteritis (Oniye *et al*. 2000). *Raillietina tetragona* which was the most prevalent cestode, has moderate to severe pathogenicity and causes obstruction of the intestine, weight loss and decreased egg production in laying pigeons (Souslby 1982).

The low prevalence of nematodes may be attributed to the food searching habits of the pigeons of not scratching below the surface soil where most infective stages of these nematodes are hidden. All the birds examined are adults and this may also have conferred certain level of host immunological response against the establishment of the nematodes.

The nematode, *Heterakis gallinarum* is non-pathogenic, but a vector for *Histomonas meleagridis* which is highly pathogenic etiologic agent of "Black-head" disease lethal to chickens, turkeys, pheasants and other fowls (Cheng 1973).

The presence of this parasite in *C. l. domestica* may cause severe debility and morbidity, while mortality may occur in extreme cases (Cheng 1973).

TABLE 2: PREVALENCE OF NEGATIVE, SINGLE, AND MIXED INFECTIONS OF HELMINTHS IN *C. l. domestica* IN ZARIA, NIGERIA

Infection type	Parasite	Frequency of occurrence	
		Total	Percentage
Single	*Raillietina tertragona*	49	37.9
	Raillietina echinobothrida	18	
	Amoebotaenia cuneata	02	
	Hymenolepis carioca	02	
	Hymenolepis camtaniana	02	
	Ascaridia columbae	14	
	Ascaridia galli	03	
	Heterakis gallinarum	01	
	Sub-total	**91**	
Double	*Raillietina tertragona + Ascaridia columbae*	06	9.6
	Raillietina tertragona + Ascaridia galli	01	
	Raillietina tertragona + Heterakis gallinarum	06	
	Raillietina echinobothrida + Ascaridia columbae	06	
	Raillietina echinobothrida + Ascaridiagalli	02	
	Raillietina cesticillus + Ascaridia columbae	01	
	Hymenolepis cantaniana + Heterakis gallinarum	01	
	Sub-total	**24**	
Triple	*Raillietina tertragona + Hymenolepis carioca+ Ascaridia galli*	01	0.83
	Raillietina tetragona + Hymenolepis cantaniana + Ascaridia galli	01	
	Sub-total	**02**	
	Total	**116**	**48.3**

TABLE 3: PREVALENCE OF HELMINTHS IN MALE AND FEMALE *Columba livia domestica* IN ZARIA, NIGERIA (MALE n=127, FEMALE n=113)

Site of recovery	Sex	Parasite	No birds infested	Prevalence (%)	No helminth parasites (%)	Mean intensity±SE
Duodenum	*Male*	*Amoebotaenia cuneata*	1	0.79	3	3.0±0.00
		Hymenolepis cantaniana	3	2.4	13	4.3±1.48
		Hymenolepis carioca	3	2.4	35	11.5±0.60
	Female	*Amoebotaenia cuneata*	1	0.88	8	8.0±0.0
		Hymenolepis cantaniana	1	0.88	11	11.0±0.0
Ileum	*Male*	Nil	0	0	0	0
	Female	*Raillietina cesticillus*	1	*0.88*	1	1.0±0.0
Duodenum/ileum	Male	*Raillietina tetragona*	39	30.7	593	15.2±1.25
		Raillietina echinobothrida	14	11.0	110	7.8±1.39
		Ascaridia columbae	13	10.2	62	4.8±1.59
		Ascaridia galli	4	3.1	56	14.0±9.17
	Female	*Raillietina tetragona*	26	23.0	552	21.2±3.38
		Raillietina echinobothrida	12	10.6	69	5.8±1.47
		Ascaridia columbae	14	12.4	223	15.9±4.86
		Ascaridia galli	4	3.5	20	5.0±1.73
Caeca	Male	*Heterakis gallinarum*	4	3.1	76	13.0±0.95
	Female	*Heterakis gallinarum*	4	3.5	8	2.0±0.61

Different species of nematodes have been associated with deficiencies in vitamin A, B1 and B12, minerals, carbohydrates and proteins (Cheng 1973; Soulsby 1982; Smyth 1994).

The cestodes were restricted to the small intestine (duodenum and ileum) while the predilection sites for the nematodes were the small intestine and caeca, where the prevailing optimum concentration of saline, glucose and other semi-digested food and debris abound (Symth 1994; Dede & Richards 1998; Frantova 2000). Such sites generally favour absorption of nutrient through the body surface of cestodes.

Single infection was highest in this study and occurred in 37.5% of the birds, followed by double infection in 10.0% while triple infection was rare and occurred in only 0.8% birds. It is possible that the higher prevalence of single species infection depends on the order of initiation of infection in the host as the first to infect the host may acquire higher micro-habitat and establishment advantage thus rendering it less suitable for late entrants. Crofton (1971) suggested that infection process of parasites tends to lead to an over dispersed distribution, with heavily infected host often killed by the parasites. Kennedy (1975) argued that food preference at a particular time may determine the establishment of either single or mixed infection. The lower prevalence of triple infection pattern may therefore suggest inability of the parasite to co-habit conveniently in the host.

The non-significant association between infection and sex and the similarity in the mean intensity of infection among the male and female birds indicates that both sexes are equally exposed to the same risk of acquiring the parasites.

The recruitment of the parasites throughout the year may be linked to the diet of the pigeons while the differences in the prevalence of individual helminths species within the months could be due to the availability and relative abundance of their intermediate hosts or infective stages. Therefore, parasites such as *R. tetragona*, *R. echinobothrida* and *Ascaridia columbae* which are found almost throughout the year will have their intermediate hosts (ants) and infective eggs available in most part of the year (Kennedy 1975). The significant association between the wet season and helminth infections could be due to the fact that insects and other invertebrates which serve as food of the birds also harbour the intermediate hosts of these parasites, and are more abundant during that season than the dry season.

This position was confirmed by the fact that Columbids feed more on animal materials comprising of termites, earthworms, *Papio* larvae, *Polyxus* sp., ants and other unidentified insects than seeds which are scarce during the wet season (Adang 1999).

Farming activities in Zaria during the early months of the wet season may help to expose the eggs of nematodes that are hidden below the surface of the soil for the birds to ingest particularly as the birds visit newly cultivated farms in large flock to feed on spilled grains during planting.

The harsh and unfavourable climatic conditions that characterize the dry season in the study area may be responsible for the low population of invertebrate hosts, and might have negatively affected the viability of onchospheres of some cestodes and the hatching of some nematode eggs, resulting in the low infection rates and worm loads in the dry season (Dede & Richards 1998).

It is concluded that cestodes are more prevalent than nematodes in domestic pigeons of Zaria area. Therefore deworming programme during the rainy season may prove to be more successful in reducing helminthiasis due to cestodes.

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