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Gastro-intestinal helminths of pigeons (*Columba livia*) in Gujarat, India

Parsani HR [1*], Momin RR [2], Lateef A [3] & Shah NM [4]

[1] Dept. of Parasitology, [2] Regional Animal Disease Investigation Center, [3] Department of Physiology & Biochemistry, [4] Department of Microbiology; College of Veterinary Science & Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada-385506, Gujarat, India

Abstract

A study was conducted to assess the prevalence of helmith parasites of domestic wild and zoo pigeons in Gujarat, India by faecal sampling and postmortem examination. Qualitative examination of 78 faecal samples revealed 71 (91%) with parasitic infections of nematodes (85%), cestodes (31%) and *Eimeria* sp (77%). There were 200-1600 nematode eggs per gram during the monsoon season, which was high compared to the 200-1000 eggs per gram in winter and summer. In post-mortems 85% had parasitic infections, of nematodes (75%), cestodes (69%) and *Eimeria* sp (58%). Two species of nematodes (*Ascaridia columbae* and *Capillaria obsignata*) and five species of three genera of cestodes (*Raillietina echinobothridia*, *R. tetragona*, *R. cesticillus*, *Cotugnia digonophora* and *Hymenolepis* sp) were identified. Despite their parasitic infections, not a single pigeon revealed any alarming clinical signs.

Keywords: gastrointestinal helminthiasis, prevalence.

Introduction

There are about 300 species of birds belonging to the pigeon and dove family, the Columbidae. The importance of pigeons in relation to domestic chicken cannot be ignored, because pigeons can act as reservoir hosts or carriers, forming a source of infection for shared common parasitic fauna (Sahu 1987). A large number of ecto- and endo-parasites are found on the skin and in the various internal organs, associated with several diseases of pigeons. However little is known about the socio-economic importance, management and health aspects of these birds.

Due to the perception of the insigificance of pigeons, little attention in terms of research has been directed towards pigeons in India. However, in many parts of the country pigeons are seen daily scavenging for food together with other poultry, and they clearly have potential as a source of infection. A study was therefore conducted into the incidence of gastro-intestinal helminths in zoo and wild pigeons of Gujarat state, India. Here we report in greater detail our work already partly published (Parsani & Momin 2010).

Materials & Methods

The study was carried out in North Gujarat, India (between 20 to 35 º N, 70 to 73 º E), in the tropical region. 78 fresh faecal samples (5-20 g each) were collected into clean sterile containers from zoo pigeons from the Kamla Nehru Zoological Garden, Kankaria, Ahmedabad. To collect from wild pigeons, feed grains were broadcasted onto a clean floor of public places and wild pigeons allowed to feed; composite faecal samples of about 20 g were then collected from the floor. Faecal samples were collected at two-month intervals for a period of one year during the morning hours.

Samples were preserved in 10% formalin and examined qualitatively using the techniques of Thienpont (1979) and Georgi (1985). Quantitative examination for nematode ova was carried out following the McMaster technique (Gordon & Whitelock 1939). A part of each sample was homogenised with 2.5% potassium dichromate solution and kept at room temperature for sporulation of coccidian oocysts (Sprent *et al.* 1967, Pande *et al.* 1970).

* Author for correspondence: tel: 91-9426705362 email : *husen46@gmail.com*

Ectoparasites were collected as described by Soulsby (1982); briefly, after killing the pigeons by anaesthesia, each was immediately placed in a polythene bag and the parasites collected after abandoning the pigeon. The ectoparasites were preserved for identification in 70% alcohol. Routine examinations were made of the entire alimentrary tract, respiratory system, liver, heart, kidney and reproductive tract. Nematodes and cestodes were removed and washed in water, and a number of nematodes cleared in lactophenol for identification; the rest were stored in 70% alcohol contining 5% glycerin for parasitological examination. Cestodes were fixed in 10% formalin and stained with carmine acid for further study. Worms were identified under a light microscope using the helminthological keys of Soulsby (1982).

Results

Qualitative faecal examination of 78 samples of pigeons revealed 71 samples (91%) with parasitic infections, in which there were nematodes (85%), cestodes (31%) and *Eimeria* species (77%) (Figs. 3 & 4) (Table 1). In nematode infections the eggs of *Ascaridia* (Fig. 1) and *Capillaria* species (Fig. 2) were common.

Types of Pigeon	**Result**	**Nematode eggs per gram**					
		Dec Jan	**Feb Mar**	**April May**	**June July**	**Aug Sept**	**Oct Nov**
Nicobar Pigeon *Caloenas nicobarica*	*Ascaridia* sp. ova *Eimeria* oocyst	400	400	200	1000	800	600
Crowned Pigeon *Goura victoria*	*Ascaridia* sp. ova *Eimeria* oocyst	400	200	200	600	200	200
Green Imperial Pigeon *Ducula aenea*	-ve	-	-	-	-	-	-
Pied Imperial Pigeon *Ducula bicolor*	-ve	-	-	-	-	-	-
Jacobin Pigeon *Columba livia* variety	*Capillaria* sp. ova *Eimeria* oocyst *Cestode* segment	1000	800	600	1200	1000	800
Green fan tail Pigeon *Columba livia* variety	*Ascaridia* sp. ova *Capillaria* sp. ova *Eimeria* oocyst	800	600	400	1400	1000	800
Black fan tail Pigeon *Columba livia* variety	*Capillaria* sp. ova *Eimeria* oocyst	600	400	400	1000	800	400
White fan tail Pigeon *Columba livia* variety	*Ascaridia* sp. ova *Capillaria* sp. ova Cestode segment	600	400	200	1200	1000	800
Shirazi Pigeon *Columba livia* variety	*Capillaria* sp. ova *Eimeria* oocyst	400	200	200	800	600	400
Pouter Pigeon *Columba livia* variety	*Ascaridia* sp. ova *Eimeria* oocyst	200	400	200	800	600	400
Khal Pigeon *Columba livia* variety	*Ascaridia* sp. ova *Capillaria* sp. ova *Eimeria* oocyst Cestode segment	600	400	600	1600	1200	800
Bronze Pigeon *Columba livia* variety	*Capillaria* sp. ova *Eimeria* oocyst	400	200	400	1000	800	400
Wild Pigeon *Columba livia*	*Ascaridia* sp. ova *Capillaria* sp. ova *Eimeria* oocyst Cestode segment	600	400	400	800	800	400

Table 1: Qualitative and quantitative examination of faecal samples of pigeons

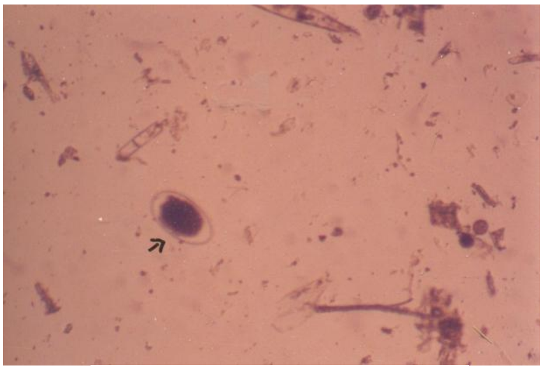

Figure 1: *Ascaridia* sp. ova (x50)

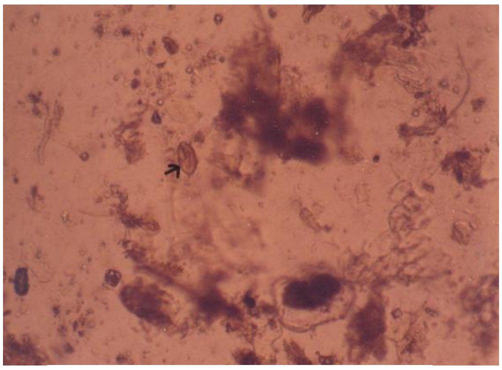

Figure 2: *Capillaria* sp. ova (x50)

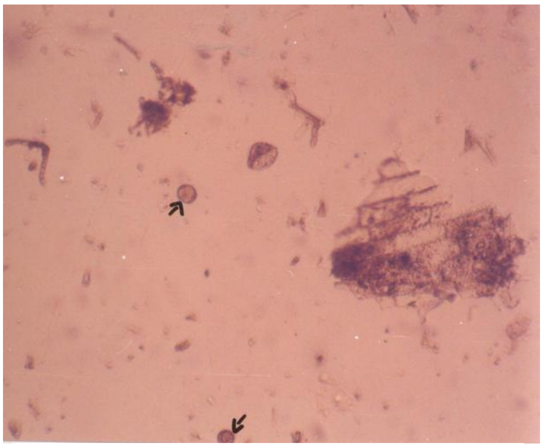

Figure 3: Unsporulated *Eimeria* oocyst (x50)

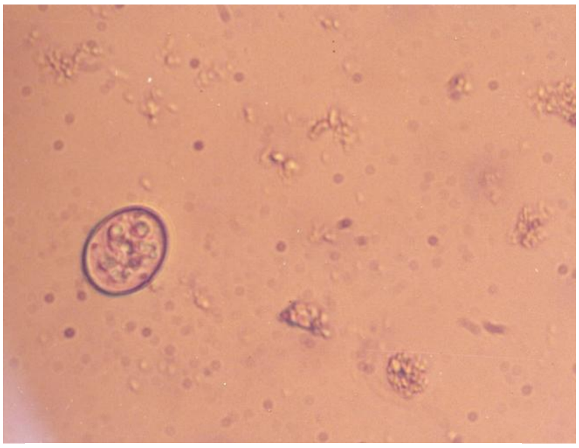

Figure 4: Sporulated *Eimeria* oocyst (x225)

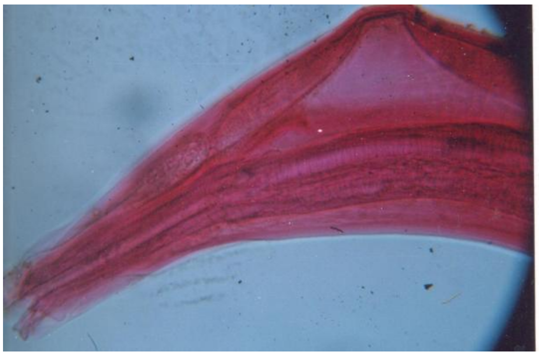

Figure 5: Anterior end of *Ascaridia columbae* (x225)

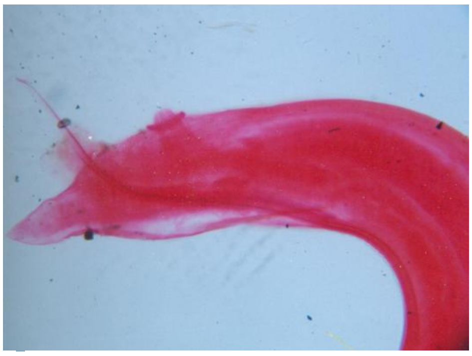

Figure 6: Posterior end of male *Ascaridia columbae* (x225)

Figure 7: Anterior end of female *Ascaridia columbae* (x225)

Figure 8: Anterior end of female *Capillaria obsignata* (x225)

Figure 9: Posterior end of female *Capillaria obsignata* (x225)

Figure 10: Obstruction and dilatation of small intestine due to *Ascaridia columbae*

Figure 11: Mild ulcer in small intestine due to *Ascaridia columbae*

Figure 12: Necrotic ulcer of the small intestine due to *Ascaridia columbae*

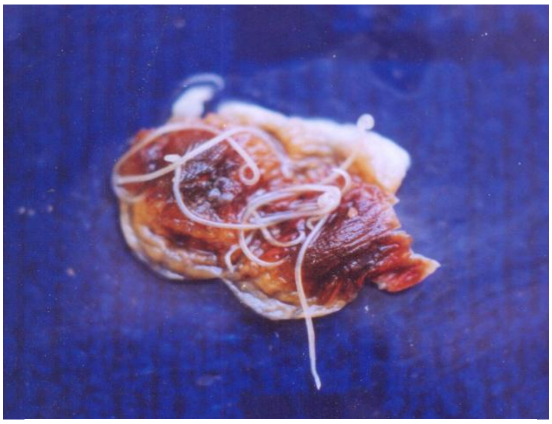

Figure 13: *Ascaridia columbae* in gizzard

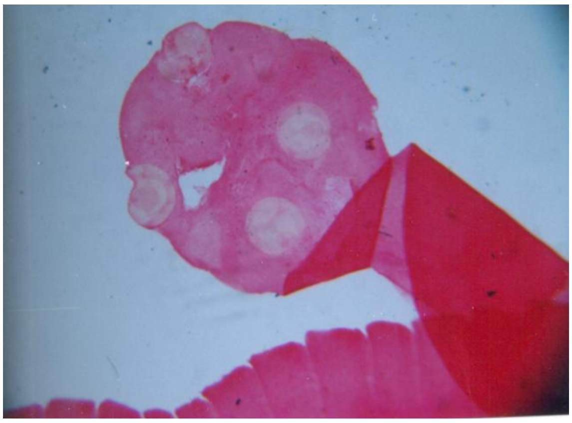

Figure 14: Scolex of *Raillietina echinobothridia* (225X)

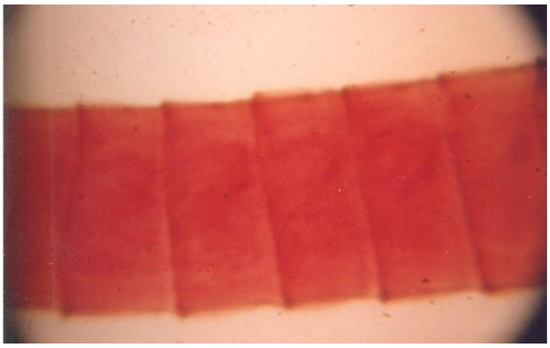

Figure 15: Mature segments of *Raillietina echinobothridia* (225X)

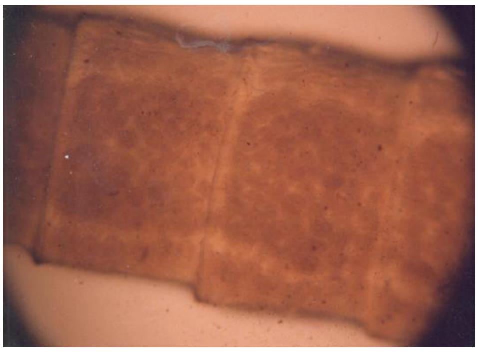

Figure 16: Gravid segments of *Raillietina echinobothridia* (225X)

Figure 17: Scolex of *Raillietina tetragona* (50X)

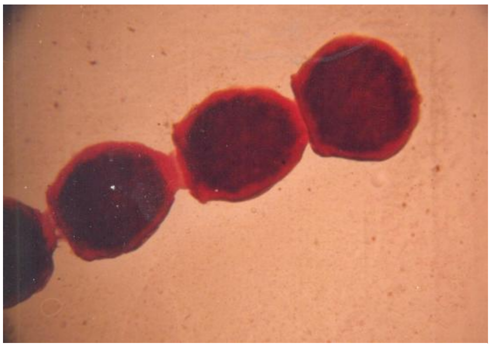

Figure 18: Gravid segments of *Raillietina tetragona* (50X)

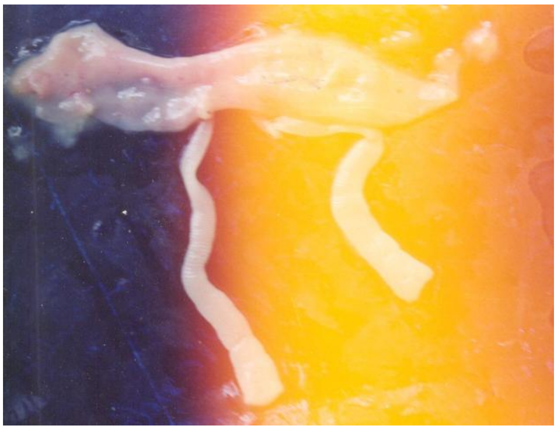

Figure 19: *Raillietina tetragona* attached to small intestine)

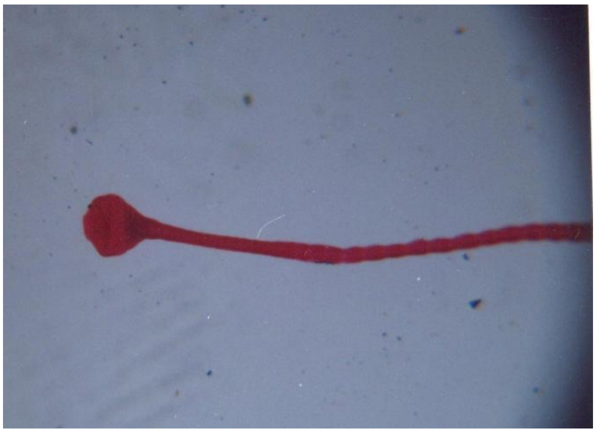

Figure 20: Scolex of *Raillietina cesticillus* (50X)

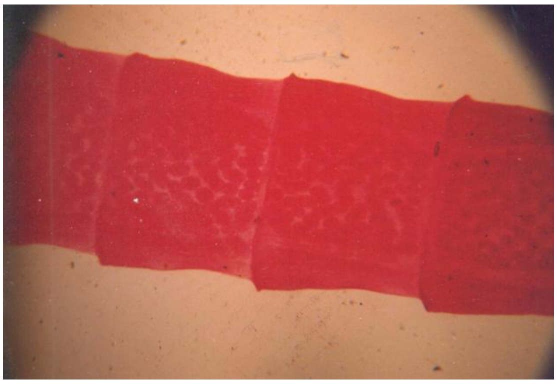

Figure 21: Gravid segments of *Raillietina cesticillus* (225X)

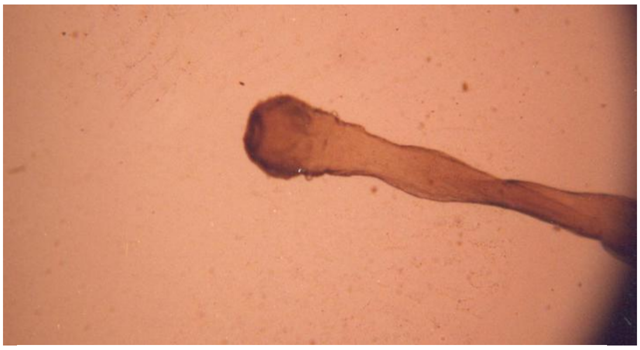

Figure 22: Scolex of *Cotugnia digonophora* (50X)

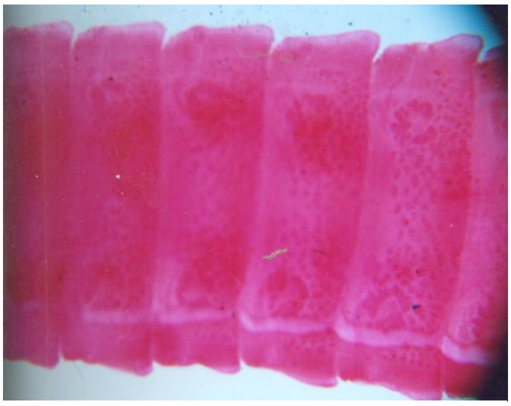

Figure 23: Mature segments of *Cotugnia digonophora* (225X)

Figure 24: Mature segments of *Cotugnia digonophora* (225X)

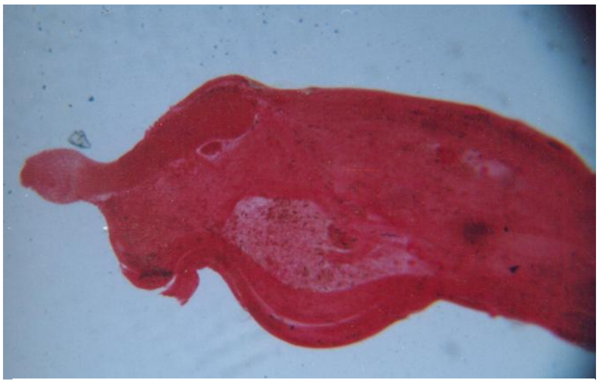

Figure 25: Anterior end of *Hymenolepis* species having umbrella shaped rostellum with single row of hooks and weak unarmed sucker (225X)

In post-mortem examinations of both zoo and wild pigeons, 80 and 88% were infected by parasites respectively. In zoo pigeons there were nematodes (91%), cestodes (72%) and *Eimeria* (66%) infections, while in wild pigeons 87% had nematodes, 87% had cestodes and 70% had *Eimeria* infections. The figures for single and multiple infections are given in Table 2, as are the average numbers of individuals found per bird.

Observation	**number of pigeons**		**total**
	zoo	**wild**	
free from parasites	8	7	15
with parasites	32	53	85
cestodes only	2	4	6
nematodes only	4	2	6
trematodes only	-	-	-
protozoa only	-	-	-
cestodes and nematodes	5	10	15
cestodes and protozoa	1	3	4
nematodes and protozoa	5	5	10
cestodes, nematodes & protozoa	15	29	44
average number of cestodes per pigeon	5.7	12.0	8.8
average number of cestodes per infected pigeon	9.9	15.6	12.8
average number of nematodes per pigeon	39.2	18.0	28.6
average number of nematodes per infected pigeon	54.1	23.5	38.8
average number of helminths per pigeon	44.9	30.0	37.5
average number of helminths per infected pigeon	56.2	34.0	45.1

Table 2: Incidence of helminths in pigeons recorded from post-mortem examinations

Nematode infection was high, and included *Ascaridia columbae* (Figs. 5, 6, 7) and *Capillaria obsignata* (Figs. 8, 9). Only mild catarrhal enteritis was noticed in the small intestine with the presence of *A. columbae* worms. In heavy infections of *A. columbae* causing obstruction, dilation (Fig. 10) caused mild to necrotic ulcers in the small intestine (Figs. 11, 12): worms were mainly found in the lumen of the small intestinal, but some were also found in the lining of the gizzard (Fig. 13) or trapped in the mesentries. *Capillaria* infections were observed in pigeons along with *A. columbae*, causing cachexia and haemorrhagic enteritis.

Cestode infection was discovered much more frequently by post-mortem examination (69%) than by faecal sampling (27%). Cestodes found during post-mortem examination were identified from the character of the rostellum, the spherical armed sucker, and the morphology of the mature and gravid segments. They were assigned to five species of three genera: *Raillietina echinobothridia* (Figs. 14, 15, 16), *R. tetragona* (Figs. 17, 18), *R. cesticillus* (Figs. 19, 20, 21), *Cotugnia digonophora* (Figs. 22, 23, 24) and *Hymenolepis* sp (Fig. 25). In heavy infections, the mucosal layer had a copious exudate.

Discussion

In India, the prevalence of parasitic infections in pigeons has been reported at 75% (Senthilvel *et al.* 2005) and 100% (Borghare *et al.* 2009). Prevalence in pigeons elsewhere vary between 29% (Turkey: Gül *et al.* 2009) and 92% (Botswana: Mushi *et al.* 2000), with other figures intermediate (48% in Nigeria, Adang *et al.* 2008; 79% in Tanzania, Msoffe *et al.* 2010; 42% in Iran, Mohammad *et al.* 2011). Ibrahim *et al.* (1995) reported *Ascaridia* sp, *Capillaria* sp, and cestode and coccidian infections in pigeons in Egypt, and Hayat *et al.* (1999) reported nematode, cestode and coccidian infections in Pakistan. Mohammad *et al.* (2011) in Iran reported 42% were infected with one or more species of helminths.

Quantitatively nematode infections were high during the monsoon (June to September) in the present study. This may be due to mean temperature and high relative humidity, which lowers the resistance of birds and favours heavy infection (Hawkins & Cole 1945). Lower rates were recorded during February to May (summer), perhaps due to the climatic conditions which are not very favourable for the development of parasitic infection. The moderate infections of the winter season (October to January) may be attributed to low temperatures which help arrest development of parasites in the host and the environment (Ogunsui & Eysker 1989).

Higher prevalences are generally reported from post-mortems (Hayat *et al.* 1999, Msoffe *et al.* 2010, Mohammad *et al.* 2011), with a variety of similar taxa reported (Tacconi *et al.* 1993, Ibrahim *et al.* 1995). *A. columbae* is one of the common nematodes of pigeons reported by a number of worker from different parts of world: Brussels (Bernard & Biesman 1987), Bangladesh (Begum & Shaikh 1987), Yugoslavia (Kulisic 1989), Spain (Martinez *et al.* 1989), Italy (Tacconi *et al.* 1993), Egypt (Ibrahim *et al.* 1995), Pakistan (Hayat *et al.* 1999), Tanzania (Msoffe *et al.* 2010) and Iran (Mohammad *et al.* 2011). Opinions about the pathogenicity of this worm vary, but it appears to be less pathogenic than some of the other pigeon nematodes.

Wehr & Shalkop (1963), Ali *et al.* (1985) and Wajihullah *et al.* (1986) all have also recorded the fact that worms can be trapped in the mesenteries. *Capillaria* infections along with *A. columbae* are known to cause cachexia and haemorrhagic enteritis in various parts of the world (Lesbouries 1953, Pouplard & Fievez 1955, Rao & Bandopadhyay 1993, Ibrahim *et al.* 1995, Pavlovic *et al.* 1996, Hayat *et al.* 1999).

Despite their low prevalence, severe haemorragic enteritis, intestinal obstruction, reduction in egg production and subsequently death have been known to occur as a result of cestode infection (Audu *et al.* 2004). *Raillietina* sp. was shown to be an important cestode of pigeons. No evidence of nodulation was observed, which is said to be a characteristic feature of *Raillietina* species (Biester & Schwarte 1957), but was also reported as absent or uncommon by Soulsby (1982) Msoffe *et al.* (2010) and Mohammad *et al.* (2011). Although, this is generally considered to be a relatively harmless parasite, it will be interesting to study the reason that pigeons seem to be more susceptible to *Raillietina* than other birds. Further investigations of health status, blood parameters and growth rate of pigeons will indicate the relative effect of these worms in pigeons. The presence of three species of *Raillietina* clearly support their cosmopolitan nature in chickens, guinea fowls, turkeys, pigeons, doves and bush fowls (Soulsby 1982, Oniye *et al.* 2001, Audu *et al.* 2004, Derakhshanfar *et al.* 2004, Moghaddas *et al.* 2010). The infective stages are carried by arthropods serving as intermediate hosts (Mushi *et al.* 2000): ants, beetles, termites, flies and other arthropods in addition to fruits and seeds form the major part of the diet of doves and pigeons (Adang 1999).

The present study showed that helminths, protozoa and ectoparasites were prevalent in pigeons. Multiple species are more frequently seen than single-species infestations, suggesting that pigeons could be more susceptible to mixed infections than chickens. Whether these have significant effects on the health and growth rate of these birds remains to be investigated. From the parasitic fauna seen in this study, for captive birds it is imperative to institute an integrated programme of parasite control through constant changing of litter, regular use of antihelminthics, anticoccidials and dusting of birds with pesticides. These may boost the productivity of domesticated pigeons, consequently augmenting the animal protein they provide.

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