



Research Article

Prevalence of Gastrointestinal Nematodes (*Capillaria* spp.) in Domestic Pigeons (*Columba livia*) in Bahawalpur, Pakistan

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Abstract | The prevalence of gastrointestinal nematodes (*Capillaria specie*) or the risk of capillariasis in domestic pigeons (*Columbia Livia*) in the Bahawalpur area of Pakistan was investigated in May 2023. Fecal samples of 100 pigeons (30 males and 70 females) belonging to 30 different breeds were collected from four different houses of the Dilawar colony area of Bahawalpur, and proceeded qualitatively through direct microscopy and floatation method. In this study, 18 (11 males and 7 females) out of the 100 samples (with a prevalence 18%) were found infected with *Capillaria* spp. of nematodes. The qualitative examination also revealed that the *Capillaria* spp. of nematodes was more prevalent in males (36.67%) than females (10%). This study will be helpful in raising awareness among pigeon owners for better control and treatment strategies for capillariasis and also to improve the health status of pigeons and provide them with a better hygienic or healthy environment.

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Keywords | Pakistan, Domestic pigeons, *Capillaria* spp., Prevalence, Fecal examination, Direct microscopy, Floatation method



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Introduction

Pigeons are widely distributed around the world and have been traditionally associated with humans since 3000–5000 B.C. (Sari *et al.*, 2008). Domestic pigeons (*Columba livia domestica*) belong to the subspecies of pigeons called rock dove (Blechman, 2007). With the exception of the poles, pigeons may be found almost anywhere in the world. Pigeons are raised for food, trade, and other uses in rural Pakistan, valued as cultural symbols. Pigeons fall into three categories: Carrier pigeons, wild and fancy pigeons,

and poultry pigeons (Tanveer *et al.*, 2011). The pigeons are kept and bred for meat, as a means of revenue, for amusement, and for religious reasons (Adang *et al.*, 2008, 2010, 2012; Alam *et al.*, 2014). The poultry industry is dealing with a number of economically significant parasite illnesses (Anwar *et al.*, 2000) and pigeons have a high prevalence of gastrointestinal (GIT) helminths and protozoan infections, just like poultry organisms (Ghazi *et al.*, 2002; Adang *et al.*, 2008). They are a significant source of disease and its transmission to both humans and birds like ducks and chicks (Patel *et al.*, 2000). The infections are primarily

transferred by fecal dust from cages that have been contaminated by urine and dry droppings (Marques *et al.*, 2007). The health of pigeons is accompanied by a number of issues. Numerous pigeon deaths have also been reported in recent years, and autopsy results showed that parasite infestation was present. The gastrointestinal tract of pigeons contains a wide variety of helminths, the majority of which are the cause of clinical and subclinical parasitism. The infection causes weight loss, anemia, growth retardation, fertility disturbances, gut epithelium issues, and a decrease in the host's immune defenses against numerous diseases (Urquhart *et al.*, 2000). This type of complication in pigeons eventually leads to death (Basit *et al.*, 2006). Nematodes present in pigeons are classified as *Ascaridia columbae*, *Dispharynx* spp., and *Capillaria* spp. (Dovc *et al.*, 2004; Ejere *et al.*, 2014; Alkharigy *et al.*, 2018). Pigeons with the *Capillaria* spp. dominant conditions are suffered from chronic gastroenteritis and anorexia, which result in severe malnutrition and mortality (El-Dakhlya *et al.*, 2016). *Capillaria* species are categorized into three sub-categories: *columbae*, *obsignata*, and *longicollis* affect pigeons. These tiny, hair-like worms, known as *Capillaria* spp., are found in pigeons' digestive tracts and produce ova that resemble lemons and have larger, brownish eggshells with bipolar plugs (Rabiu *et al.*, 2017). Pigeon blood and feces samples are used to determine the pathological and physiological status of animals exposed to the infectious bacterium (Joshi *et al.*, 2002). The parasites cause diseases in birds such as fever, anorexia, nephritis, fatty liver, lymphocytosis, edema in the lungs, and occlusion of brain capillaries (Jordan and Pattison, 1996; Aiello and Mays, 1998). When the nematode infection is severe, the pigeons' health is negatively impacted, resulting in emaciation, death in young birds, weight loss, stunted growth, stinginess, damage to the stomach, and epithelial reproductive abnormalities (Urquhart, 1996). In Africa, Central and South America, several Caribbean islands, and portions of Asia, parasites are endemic and have a wide range of hosts and vectors. Several parasite species have been isolated from birds, however, only a small number of these are harmful. Canaries, falcons, pigeons, domestic chickens, penguins, ducks, and various marine avifauna are all infected by the parasites (Brossy, 1992; William, 2005). Nematodes from the genus *Capillaria* can be found in the part of a bird's digestive system that is anterior to the intestine. *Capillaria* infestations have frequently been extremely severe. Affected organs

include the stomach, intestines, esophagus, and crops. Breeders may have output losses due to *Capillaria* spp., and birds may experience considerable growth depression and mortality (Permin *et al.*, 1999).

The nematode has been determined to be a member of the *Capillaria anulata* and *C. contorta* species. In an adult specimen, *Capillaria* appears as thread-like worms directly behind the head area and are slightly more posterior in the cervical sections. In the optical region, wavy transverse folds appear to bulge like a bladder. Intestinal worms of the *Capillaria* spp., sometimes known as roundworms, can produce fewer eggs and cause severe symptoms such as diarrhea, fatigue, and weight loss. The disorder is also known as capillariasis. The crop, esophagus, and intestinal tract are only a few of the areas of the digestive system that are paralyzed by the many species of *Capillaria*. The *Capillaria* spp., sometimes known as threadworms or hairworms, can be extremely harmful and result in life-threatening illnesses. Pigeons' intestines contain the thin thread worms *Capillaria columbae* and *C. longicollis*, which deposit distinctive bipolar eggs with a lemon-shaped form. The small intestines of racing pigeons are home to the thin threadworms *Capillaria columbae* and *C. longicollis*, which lay distinctive bipolar eggs with a lemon-like form. Clinically, racing pigeons with capillariasis can exhibit severe disease, and it has been believed that worms could reduce race performance (Figure 1).

Materials and Methods

Study area

This study was carried out in Bahawalpur city at a temperature of 35°C and a humidity of 52%. Bahawalpur is a city in the Punjab province of Pakistan. The climate condition of Bahawalpur is subtropical, in summer temperatures remain between 35 °C to 45 °C and fall to below 4°C during winter.

Study location

The study was conducted in the Dilawar colony areas of Bahawalpur, at 29°22'52.6"N 71°41'43.6"E (Figure 2).

Collection of fecal samples

The fecal samples were collected from a total of 100 pigeons. The relevant details (sex and breed) were written on each pigeon's label. Carefully selected food and water were given.

Feed grains were spread out on a cage floor for the pigeons to eat on for composite feces. Fresh fecal samples of around 1g each were collected from the cage's floor. To reduce the risk of fecal contamination, the top layer of the feces was removed. Clean plastic bags were used to collect each and every fecal sample. The relevant details (sex and breed) were also mentioned on the plastic bags with the help of the information gathered from the pigeon owners (Figure 3).

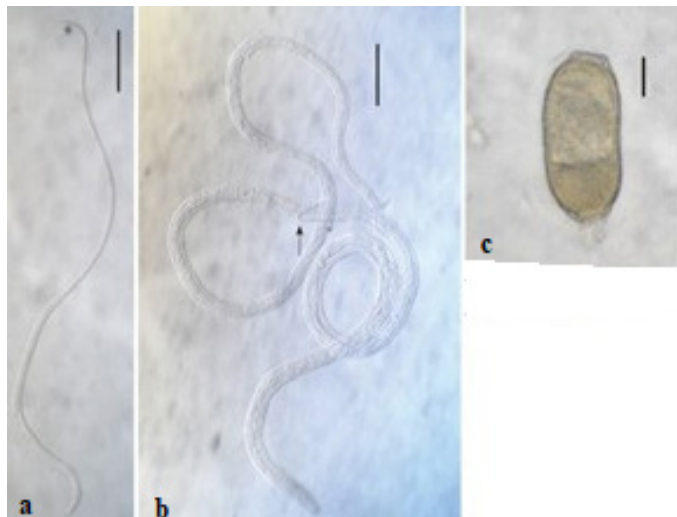


Figure 1: (a) Male worm of *c.* (b) Female worm of *Capillaria* spp. (c) Egg of *Capillaria* spp. of nematodes taken from (Jung et al. 2012).

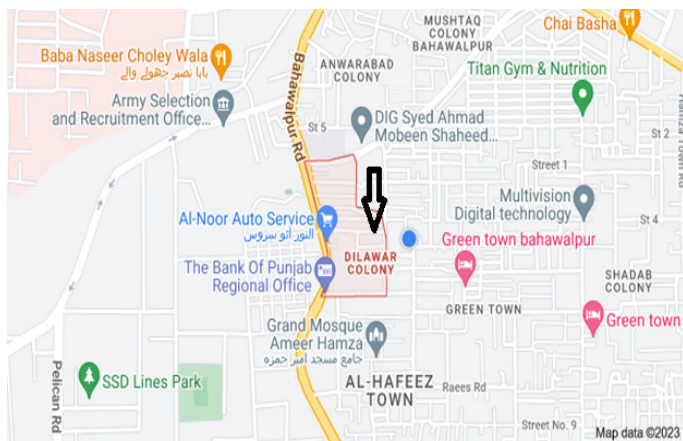


Figure 2: Taken by a Google map shows the area (DILAWAR COLONY) that is selected for research purposes <https://www.google.com/search?q=dms+of+dilawar+colony+bahawalpur+location+google&oeq=dandaqs=chrome.0.69i5913j69i57j69i6014.2648j0j7&sourceid=chrome&ie=UTF-8#>

Fecal examination

For qualitative analyses, fecal samples were processed. Direct microscope examination and simple flotation techniques were used to qualitatively analyze fecal samples.



Figure 3: (a, b, c, d, e) shows the pigeons that were used in research and their breeds names in the local language mentioned in Table 1.

Qualitative method

Direct microscopy method/ direct microscope examination. For the direct microscopy method, the following materials were used; fecal samples, glass slides, cover slips, toothpicks, and a microscope. The direct microscopy method recommended by William (2001) was used. On a clean, grease-free glass slide, a tiny amount of feces was deposited with the help of a toothpick. After removing any debris, the fecal sample was properly mixed with 1-2 drops of water. Then a cover slip was placed carefully on the fecal sample to avoid any type of bubble formation and then the slide

was examined under the microscope at 10X objective.

Table 1: Breeds name of those pigeons that are used in research.

S.No	Pigeon's breed	S.No	Pigeon's breed
1	Asmani kabutar	2	Siyah borey
3	Neely kately	4	Siyah khan
5	Ghorey	6	Chuptu ky klyare
7	Siya togha	8	Ratta patela
9	Ratte khagre	10	Peela
11	Siya khal kelyare	12	Sbuk mukhiya
13	Lal band	14	Lal bora
15	Kasid gora	16	Kal yara bora
17	Lal bora	18	Halwai bora
19	Siya khal	20	Peela baz
21	Ghora	22	Lal pamur
23	Lal bilka	24	Bhura
25	Lal chuptogha	26	Hambeera chup
27	Lal Chupli	28	Kala
29	Latha chotinok wala	30	Latha jutti pucharwara

Note: Pigeon's breed names are in the local language.

Simple flotation method

For the simple floatation method, the materials used were; fecal samples, glass slides, cover slips, saturated sodium chloride solution, glass tube, glass tube rack, cotton cloth, and a microscope. With slight adjustments, a flotation method, as described by Dranzoa et al. (1999), was used to find nematode eggs. The fecal sample was measured (1g) and combined with a 10% saturated sodium chloride solution. The fluid was poured into the glass tube after being strained through a cotton cloth. More saline solution was added to a glass tube to get a positive meniscus, and then a coverslip was placed directly on top of the glass tube. The glass tube stood motionless for ten to fifteen minutes in a glass tube rack. After 10-15 minutes, the coverslip was taken off and put on a spotless microscope glass slide. The slide was observed under the microscope at 10X objective.

Results and Discussion

A qualitative examination (direct microscopic method and simple floatation method) of 100 pigeons belonging to the 30 breeds taken from 4 different houses revealed 18 samples with parasitic infection; *Capillaria* spp. of nematodes as shown in Table 2. The total number of pigeons observed during this research was 100; and of 100 samples,

18 were infected (prevalence of 18%). Of 100 pigeons, 30 were males and 70 were females. Of 30 males, 11 were infected (prevalence of 36.67%) with nematode infection (*Capillaria* spp.). Of 70 females, 7 were infected (prevalence of 10%) with nematodes infection (*Capillaria* spp.) as shown in Table 3 and an incidence is 18%.

Table 2: Location/Area.

Study region	Location	No. of samples	No. of samples positive (n)	Prevalence (%)
Bahawalpur	Dilawar colony	100	18	18%

Table 3: Pigeon's sex-wise incidence of nematode.

Sex	Total no. of pigeon	No. of infected samples (n)	Prevalence (%)
Male	30	11	36.67%
Female	70	7	10%
Total	100	18	18%

100 pigeons were taken from 4 different houses as shown in Table 4. From house No. 1, 40 samples were collected, out of which 9 samples were infected with the *Capillaria* spp. of nematodes (prevalence of 22.5%). From house No. 2, 20 samples were collected, out of which no sample was positive for nematode. From house No. 3, 20 samples were collected, out of which 3 samples were infected with the *Capillaria* spp. of nematodes (prevalence of 15%). And from house No. 4, 20 samples were collected, out of which 6 samples were infected with the *Capillaria* spp. of nematodes (prevalence of 30%) as shown in Table 4.

Table 4: Houses where the fecal samples were collected.

Houses	No. of samples	No. of samples in which nematodes (<i>Capillaria</i> spp.) were detected	Prevalence (%)
House No. 1	40	9	22.5%
House No. 2	20	0	0%
House No. 3	20	3	15%
House No. 4	20	6	30%

It is revealed that the same type of breed was taken from four different houses but some pigeons were infected with the *Capillaria* spp. of nematodes and some were not as shown in Table 5 due to hygienic and un-hygienic differences in their living areas as shown in Figure 4.



Figure 4: Shows the pigeons' living areas at; (a) House No. 1 (b) House No. 2 (c) House No.3 (d) House No. 4.

Table 5: Presence or absence of *Capillaria* spp. of nematodes in the same breeds of pigeons in different houses.

S. No.	Pigeon's breed name	House no. 1	House no. 2	House no. 3	House no. 4
1	Asmani kabutar	Yes	No	No	No
2	Neely kately	No	No	Yes	No
3	Ghorey	Yes	No	No	No
4	Siya togha	No	No	No	No
5	Ratte khagre	No	No	No	No
6	Siya khal kelyare	No	No	No	No
7	Lal band	No	No	No	No
8	Kasid gora	No	No	No	No
9	Lal bora	No	No	No	Yes
10	Siya khal	Yes	No	No	No
11	Ghora	No	No	No	Yes
12	Lal bilka	No	No	No	No
13	Lal chuptogha	Yes	No	No	No
14	Lal chupli	No	No	No	No
15	Latha chotinok wala	Yes	No	No	No
16	Siyah borey	No	No	No	Yes
17	Siyah khan	No	No	Yes	No
18	Chuptu ky klyare	No	No	No	No
19	Ratta patela	No	No	No	No
20	Peela	No	No	Yes	No
21	Sbuk mukhiya	Yes	No	No	No
22	Lal bora	No	No	No	Yes
23	Kal yara bora	No	No	No	No
24	Halwai bora	No	No	No	No
25	Peela baz	Yes	No	No	No
26	Lal paper	Yes	No	No	No
27	Bhura	No	No	No	Yes
28	Hambeera chup	No	No	No	No
29	Kala	Yes	No	No	No
30	Latha jutti pucharwara	No	No	No	Yes

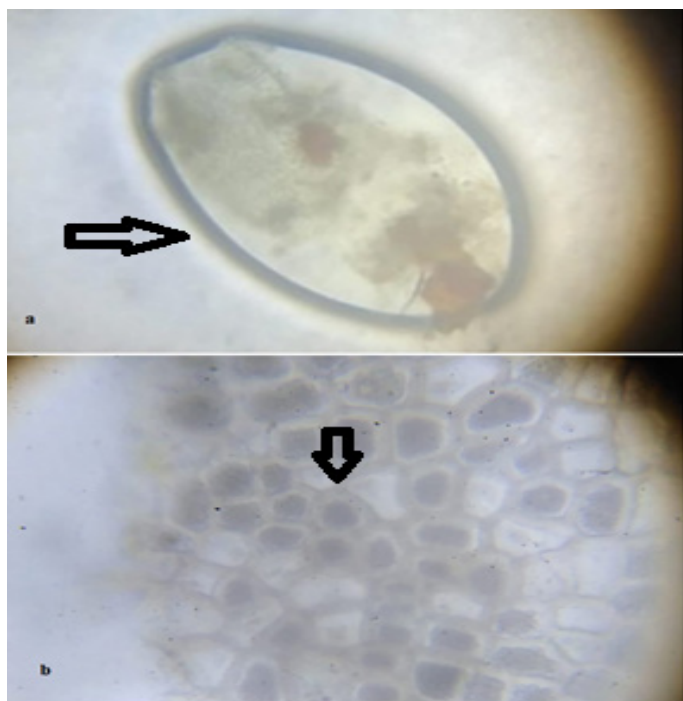


Figure 5: Identification of *Capillaria* spp. of nematode under the microscope at 10X objective (a) *Capillaria* spp. the egg at the initial stage of development has a barrel-like shape and a thicker outer shell (b) The sac of the *Capillaria* egg is found in rounded or oval structures and their color may be whitish, yellowish, and opaque apparently.

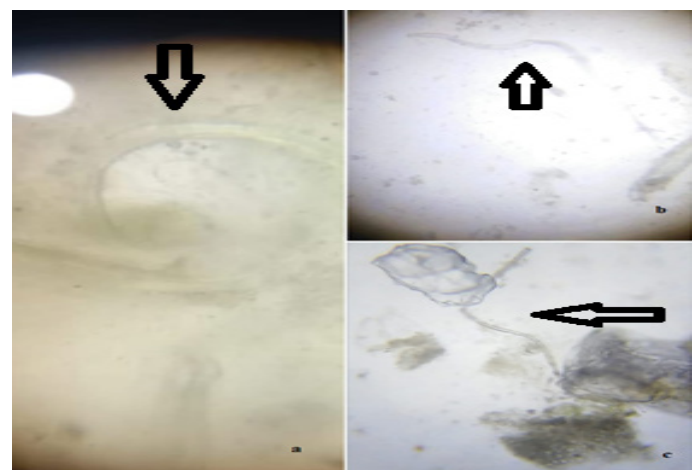


Figure 6: Identification of *Capillaria* spp. of nematode under the microscope at 10X objective (a) *Capillaria* spp. Female: Female *Capillaria* spp. are larger and have a thicker, more cylindrical body. Their tail is typically more rounded (b, c) *Capillaria* spp. Male: Male *Capillaria* spp. are smaller in size than females and have a more cylindrical and tapered body.

Table 6: Names of the infected breeds found in Males (11) and females (7) pigeons.

S. No.	Sex	Breed Name
1	Male	Asmani kabutar
2	Male	Ghorey
3	Male	Siya khal
4	Female	Lal chuptogha
5	Female	Latha chotinok wala
6	Female	Sbuk mukhiya
7	Male	Peela baz
8	Female	Lal pamur
9	Male	Kala
10	Male	Neely kately
11	Male	Siyah khan
12	Female	Peela
13	Male	Lal bora
14	Male	Ghora
15	Female	Siyah borey
16	Male	Lal bora
17	Male	Bhura
18	Female	Latha jutti pucharwara

Table 7: Names of the infected breeds found in males.

S. No.	Sex	Breed name
1	Male	Asmani kabutar
2	Male	Ghorey
3	Male	Siya khal
4	Male	Peela baz
5	Male	Kala
6	Male	Neely kately
7	Male	Siyah khan
8	Male	Lal bora
9	Male	Ghora
10	Male	Lal bora
11	Male	Bhura

Table 8: Names of the infected breeds found in females.

S. No.	Sex	Breed name
1	Female	Lal chuptogha
2	Female	Latha chotinok wala
3	Female	Sbuk mukhiya
4	Female	Lal pamur
5	Female	Peela
6	Female	Siyah borey
7	Female	Latha jutti pucharwara

In the present study, the prevalence of *Capillaria* spp. in pigeons was examined in terms of sex, breed, and

location. In adult specimens, *Capillaria* are thread-like worms that are located directly behind the head area. In the cervical regions, wavy transverse folds give the optical section the impression of a bladder-like enlargement.

This research work identified the presence, prevalence, and identification of *Capillaria* spp. in the study regions, and the same parasitic species was identified in pigeons and poultry all over the world (Mushi et al., 2000; Marques et al., 2007; Adang et al., 2008; Borji et al., 2012; Eljadar et al., 2012; Hussein et al., 2014; Sood et al., 2018).

The current study focused on the intestinal worms *Capillaria* spp. that are present in domestic pigeons. The results are in agreement with previous studies (Fowler, 1996; Muhairwa et al., 2007; Muthusami et al., 2017; Qamar et al., 2017). Additionally, domestic chickens were shown to have these intestinal parasites. Another study found that the prevalence of the same *Capillaria* spp. infection in pigeons was 57% overall, with a prevalence rate of 60% in wild pigeons and 55% in domestic pigeons (Basit et al., 2006). *Capillaria* spp. in domestic pigeons was reported at about 10.1% by Khezerpour and Naem (2013) while Patel et al. (2000) reported 53.57% prevalence of *Capillaria* spp. and Borghare et al. (2009) documented about 56.66% prevalence of *Capillaria* spp. in pigeons. *Capillaria* spp. prevalence was reported about 6% by a study conducted in Egypt, (Bahrami et al., 2011). However, one more study presented a 67.2 % prevalence of *Capillaria* spp. (Tanveer et al., 2011), and in another study, it was found about 32.56% of *Capillaria* spp. (Marques et al., 2007b). In a study conducted in 2007, *Capillaria* spp. was found in 36.4% of fancy pigeons and only 3.6% in the carrier breeds, of a total of 103 pigeons of 32 different breeds, (Dehlwi, 2007). A 4% prevalence of *Capillaria* spp. in domestic pigeons was reported in Libia (Alkharigy et al., 2018) while in Turkey a 19.9% prevalence was reported in domestic pigeons (Sari et al., 2008). During race season, the *Capillaria* spp. among the endoparasites was also observed in pigeons (Zigo et al., 2019). Variations in the health status of the birds studied, as well as climatic and geological circumstances in the research sites, may be responsible for the observed variation in prevalence. These variations show that the endoparasitic burden of *Capillaria* spp. is more prevalent in the studied regions and should not be disregarded. The higher prevalence might be due to the presence

of high levels of humidity and moderate temperature in the study regions as these are the major factors for the parasites to survive.

Conclusions and Recommendations

It is concluded that the information provided by the current research on capillariasis in Bahawalpur will be useful in spreading awareness among pigeon owners for better control and treatment strategies for capillariasis. It is also observed that there is a difference between hygienic and non-hygienic environments which is provided to the pigeons. Pigeons that live in hygienic environments, show fewer parasitic infections; while the pigeons that live in un-hygienic environments provide the high-risk factors of capillariasis.

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Novelty Statement

The prevalence of gastrointestinal nematodes (*Capillaria* spp.) in domestic pigeons were first time investigated in the Bahawalpur, Pakistan and also reveal the cause of its prevalence. Consequently, un-hygienic environment increases the rate of capillariasis in domestic pigeons.

Author's Contribution

Anshara Javed Qureshi generate the idea, did investigation, field work, paper writing and also writing the original draft.

Dr. Ishrat Aziz provided the guidance and supervision of the whole research work.

Conflict of interest

The authors have declared no conflict of interest.

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