

Epidemiology and pathology of *Trichomonas gallinae* in the common pigeon (*Columba livia*)

N. Begum, M.A.A. Mamun, S.A. Rahman and A.S.M. Bari¹

Department of Parasitology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

¹Department of Pathology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract

Pigeons (n=300) were examined during July 2007 to June 2008 in different areas of Mymensingh district. Of the pigeons examined, 202 (67.3%) were infected by *Trichomonas gallinae* (Rivolta, 1878). Prevalence of *Trichomonas gallinae* was higher in female pigeon (70.9%) than male pigeon (63.8%). Adult pigeons aged >3 months were comparatively more affected (75%) than the squab aged <30 days (72.1%) and the younger aged between 30 days to 90 days (64.7%). *T. gallinae* infection was significantly ($P<0.01$) lower in summer (48.4%) than rainy (69.8%) and winter (69.3%) seasons. Pathological lesions were confined in the crop, proventriculus and liver. There was an accumulation of greenish fluid and/or cheesy material in the crop and proventriculus. At necropsy, yellowish to grayish necrotic lesions were evident in the crop and proventriculus. On the other hand, the liver became congested where congestion of sinusoids and focal accumulation of heterophils in the parenchyma were found. But, no microscopic lesions were seen in the crop and proventriculus although gross lesions were more prominent in these two organs.

Keywords: *Trichomonas gallinae*, Pigeons, Epidemiology, Pathology

Introduction

Among the various types of parasites *Trichomonas gallinae* is regarded as the largest inhibitor to today's racing pigeon performance in Europe and other countries. *T. gallinae* a protozoan parasite, which causes the disease in pigeon called as canker mainly affecting the crop, esophagus, liver and lung. Trichomoniasis is cosmopolitan in distribution. In captive birds, the disease has been found in domestic and/or common pigeons, doves, quail, turkeys, chickens, falcons, hawks, various finches, the Java sparrow, and canaries. In wild birds, the disease is found in doves and feral pigeons causing serious threat to these birds (Bon Durant and Honigberg, 1994). In young birds, the infection is severe and even fatal where mortality can reach up to 80-90% or more in squabs (Soulsby, 1982). With virulent strains, mortality may be as high as 50% in adults before sufficient immunity is developed (McDougald, 1992). Pigeons are often associated with transmission of trichomoniasis to turkeys and chickens. Nearly all pigeons are carriers of this organism apparently because of existence of numerous strains (McDougald, 1992). Occurrences of many parasites including trichomoniasis have been reported from neighbouring countries. In Bangladesh, Begum and Shaikh (1987) recorded only helminths of pigeon while Nasrin (2004) reported different parasites from pigeon. But published reports about the parasites of pigeon and specially of protozoan parasites are scanty in Bangladesh. An in-depth study regarding epidemiology (frequency, distribution and risk factor) of *T. gallinae* is required to institute control strategies. For this purpose proposed investigation were taken to address properly the parasitological and pathological condition of the protozoon.

Materials and Methods

The study was conducted from July 2007 to June 2008. A total of 300 pigeons were purchased from the farmer's households and local markets of different areas of Mymensingh district. Samples collected from the upper digestive tract of domestic pigeon. At first a cotton swab was fluffed up a bit and immersed in distilled water. The excess fluid was removed and

the swab was inserted into the crop. All walls of the crop was contacted by using a swirling motion with the swab which was then withdrawn and the fluid hold in the cotton pressed onto a slide with the help of a spatula or blunt knife. The protozoon was seen to move about in a some what jerky wobbling motion observing immediately under light microscope.

Collected samples were preserved and stained by the Giemsa's method as described by Cable (1957) and morphology was studied (Abraham and Honigberg, 1964). Simultaneously severely infected pigeons were slaughtered to find out the lesions produced by protozoa and histopathological studies were carried out. The gross pathological lesions were recorded and the affected organs were collected and preserved with 10% buffered neutral formalin. For histopathological study, suspected tissues were processed, embedded in wax, cut in appropriate thickness and stained with haematoxylin and eosin (Luna, 1968).

The year was divided into three seasons such as monsoon (July-October), winter (November-February) and summer (March-June) seasons. The pigeons were divided into three age categories such as squab (<30 days of age), young pigeons (30 days to 90 days of age) and adult (>3 months of age). In pigeons, sexes were identified by using conventional methods and confirmed through the detection of male and female reproductive system after slaughtering. Age was determined by taking history from the pigeon owner.

Statistical analysis

The data was analyzed statistically by using chi-square test to determine the relation of *T. gallinae* infection in pigeon with seasons of the year, but to co-relate the prevalence with age and sex of the host t-test were used (Mostafa, 1989). Odds ratio was obtained by the formula according to the Schlesselman (1982).

Results and Discussion

Epidemiological aspects of *Trichomonas gallinae* in pigeon

Overall prevalence of *Trichomonas gallinae*: During this study (July 2007 to June 2008) 67.3% pigeons (n=202) were infected with *T. gallinae* which supported the findings of McKeon *et al.* (1997) and De Carli *et al.* (1979), who recorded 59.0% and 62.3% prevalence of *T. gallinae* in pigeons in Australia and Brazil, respectively. But, the present finding is found higher prevalent rate than that of Catelli *et al.* (1999), Tasca and Carli (1999) and Toro *et al.* (1999), who reported 32%, 26.5% and 11% *T. gallinae* infection in pigeon in Italy, Brazil and Chile, respectively. Dorrestein *et al.* (1990) reported the lower prevalence rate in Germany and Netherlands. They recorded 27% of Munich and 46% of the Dutch pigeons. This disparity among the findings might be due the variations in the method of study, geo-climatic condition of the research and husbandry practices of the pigeons.

Sex related prevalence: Prevalence of *T. gallinae* infection varied in relation to sex. Although not statistically significant but higher rate of infection was detected in female pigeons (70.9%) than the male (63.8%) pigeons. Female pigeons were 1.4 times more susceptible to *T. gallinae* infection than males (Table 1). The cause of higher prevalence of *T. gallinae* infection can not be explained exactly but it is supposed due to female sex hormones that make the individual more susceptible to any infection (Lloyd, 1983).

Table 1. Effects of sex on the prevalence of *Trichomonas gallinae* in pigeons

Parameters	Pigeons examined (N=300)	Pigeons infected	Prevalence (%)	P value	Odds ratio (OR)
Female	148	105	70.9	0.3 ^{NS}	Female Vs Male=1.4
Male	152	97	63.8		

N= Total pigeons examined

NS=Not significant

Age related prevalence: Age of the host had an effect on the prevalence of *Trichomonas gallinae* in pigeons. Prevalence of *T. gallinae* was lower (64.7%) in young aged between 30 to 90 days than in squabs aged <30 days (72.1%) and in adult pigeons aged >90 days (75%; Table 2), which supported the findings of Hinshaw (1965) and Nasrin (2004). Hinshaw (1965) reported the major inroads of the *T. gallinae* occurred at 16-30 weeks of age in turkey. Nasrin (2004) reported the overall helminths incidence was higher in adult pigeons than in squabs. But, Soulsby (1982) reported 80-90% or more of the adult pigeons were infected with *T. gallinae*. Calculated odd ratio implied that squabs were 1.4 times more susceptible to young, but the adult pigeons were 1.6 times more susceptible than young pigeons. On the other hand, adult pigeons and squabs were almost equally (odds ratio 1.2) susceptible to *T. gallinae* infection.

Table 2. Effects of age on the prevalence of *Trichomonas gallinae* in pigeons

Age Group	Pigeons examined (N=300)	Pigeons infected	Prevalence (%)	P value	Odds ratio (OR)
Squab (<30 days)	86	62	72.1	0.6 ^{NS}	Squab Vs Young =1.4
Young (30days - 90 days)	198	128	64.7		Adult Vs Young =1.6
Adult (>90 days)	16	12	75.0		Adult Vs Squab =1.2

N= Total pigeons examined

NS=Not significant

Seasonal prevalence: It was observed that seasons of the year had a profound effect on the prevalence of *T. gallinae* in pigeons. Prevalence of *T. gallinae* was the highest in the rainy season (69.8%) followed by winter (69.3%) and summer (48.4%) seasons (Table 3). But, different finding was recorded in turkey, where Hinshaw (1965) reported the major inroads of the *T. gallinae* occurred during midsummer and later. This difference might be due to the species variation, hormonal influence and methods of husbandry in the pigeon. It was revealed that pigeons were 2.5 times more susceptible to *T. gallinae* infection in rainy season than in summer season. But in winter season, pigeons were 2.4 times vulnerable to *T. gallinae* infection than summer. On the other hand, in the rainy season and in winter pigeons were almost equally (odds ratio 1.02) susceptible to *T. gallinae* infection.

Table 3. Effects of seasons on the prevalence of *Trichomonas gallinae* in pigeons

Parameters	Pigeons examined (N=300)	Pigeons infected	Prevalence (%)	P value	Odds ratio (OR)
Rainy	129	90	69.8	0.0 ^{**}	Rainy Vs Winter =1.02
Winter	140	97	69.3		Winter Vs Summer =2.4
Summer	31	15	48.4		Rainy Vs Summer =2.5

N= Total pigeons examined

**=P<0.01

Lesions produced by *T. gallinae* in different organs of pigeons

Obviously the course of the disease in pigeon varies with the strain of *T. gallinae* (Stabler, 1947; Stabler and Herman, 1951). Pathological lesions were confined in the crop, proventriculus and liver. There was an accumulation of greenish fluid and/or cheesy material in the crop and proventriculus. On post mortem examination, yellowish to grayish necrotic lesions were evident in the crop and proventriculus. These findings confirmed the findings of Soulsby (1982) who reported the similar lesions in mouth, crop and esophagus. The author reported the small yellowish circumscribed areas in the mouth cavity, esophagus, crop and proventriculus. The esophageal portion of proventriculus is mostly affected (Fig. 3), which supported the findings of Hinshaw (1965). No microscopic lesions were seen in the crop and proventriculus although gross lesions were more prominent in these two organs. That might be due to the presence of avirulent strains, which did not cause any lesions or the lesion might be in subclinical form or the lesion was in early stages. Grossly the liver became congested. Soulsby (1982) also reported the similar liver lesions with *T. gallinae* infection. Microscopically congestion of sinusoids (Fig. 1) and focal accumulation of heterophils in the parenchyma of liver (Fig. 2) were observed, which confirmed the findings of Perez Mesa *et al.* (1961) who reported the focal necrotic abscesses in all zones of lobules of liver with an inflammatory reaction characterized by mononuclear cells and heterophils. Soulsby (1982) and McDougald (1992) never reported the lesions due to *T. gallinae* in the digestive tract below the proventriculus but in the present study both gross (Fig. 4) and microscopic lesions were found in the gizzard. Grossly the lesions were similar to that of crop and proventriculus but different microscopic lesions were observed. The muscle layer was thickened and there was formation of granulomatous type of reaction (Fig. 5). The granuloma was mainly formed by the mononuclear cells (Fig. 6). But these were not confirmed whether the lesion was due to *T. gallinae* or other organisms. As the gross lesion of both proventriculus and gizzard was similar so the authors suggested that the lesions might be due to *T. gallinae*. Further research should be conducted to solve the question.

The present study suggests that pigeons commonly reared in Bangladesh are very much susceptible to *T. gallinae* infection irrespective to age and sex of pigeons and seasons of the year. So proper treatment against this protozoon is essential. Further research may be implicated towards economic aspects of *Trichomonas gallinae* in domestic pigeon as well as to develop its preventive measures.

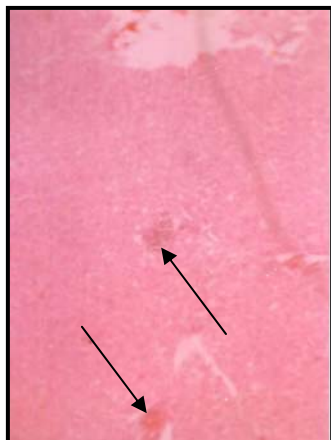


Fig. 1. Section of a pigeon liver stained with H&E. Congestion of sinusoids was seen (833x)

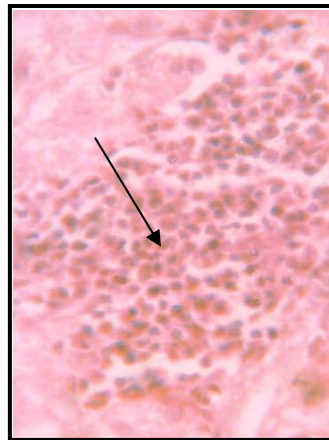


Fig. 2. Section of a pigeon liver stained with H&E showing focal accumulation of heterophils in the parenchyma (833x)

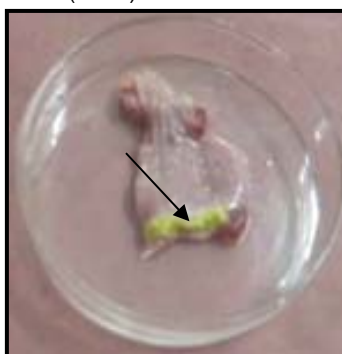


Fig. 3. Yellowish to grayish necrotic lesions in the proventriculus

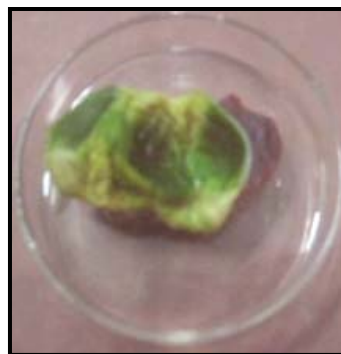


Fig. 4. Yellowish to grayish necrotic lesions in the gizzard

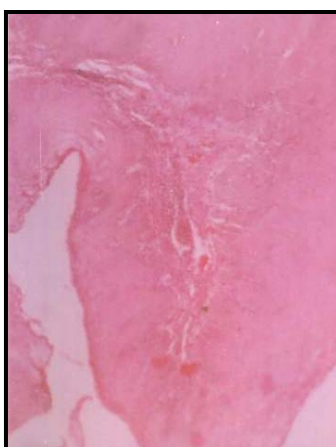


Fig. 5. Section of a pigeon gizzard stained with H&E. Thickened muscle layer was seen (833x)



Fig. 6. Section of a pigeon gizzard stained with H&E showing mononuclear cells infiltration (833x)

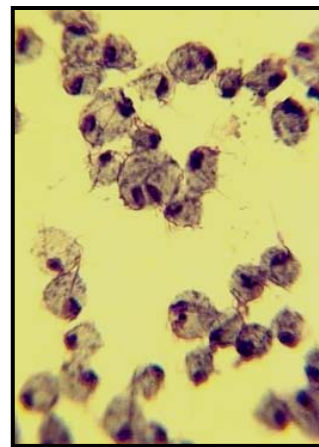


Fig. 7. *Trichomonas gallinae* stained with Giemsa's stain (833x)

Acknowledgements

The authors are grateful to the Bangladesh Agricultural University Research System (BAURES) authority for necessary financial support to conduct the research.

References

- Abraham, R. and Honigberg, B.M. 1964. Structure of *Trichomonas gallinae* (Rivolta 1878), *The Journal of Parasitology*, 50: 608-619.
- Begum, N.J. and Shaikh, H. 1987. Prevalence of helminth parasites of pigeons (*Columba livia*), *Bangladesh Veterinary Journal*, 21: 89-93.
- Bon Durant, H. and Honigberg, B.M. 1994. *Trichomonas* of Veterinary Importance In: Kreier, J. P. ed. *Parasitic protozoa*, 2nd edition, Academic Press, New York, Vol. 9, p. 112-188.
- Cable, R. M. 1957. *An Illustrated Laboratory Manual of Parasitology*, Burgess Publishing Co., 426, South Sixth Street, Minneapolis 15, Minnesota, pp. 105-131.
- Catelli, E., Poglayen, G., Terregino, C., Orlando, C., Tonulli, A. Issa-Gadale, O. Roda, R. and Agnoletti, A. 1999. Survey of endoparasits of digestive tract of *Columba livia* (Gmelin, 1787) in Florence, *Selezino Veterinaria*, 2: 75-85.
- De Carli, G.A., Pansera, M.C.G. and Guerrero, J. 1979. *Trichomonas gallinae* (Rivolta, 1878) Stabler, 1938, no trato digestivo superior de pombos domésticos, *Columba livia*, no Rio Grande do Sul – Primeiro Registro. *Acta Biol Leopoldensia*, 1: 85-95.
- Dorrestein, C.M., Korbelt, R. and Schneegans, D. 1990. Observations of health of feral urban pigeons. VII. *Tagung Uber Vogel Krankheiten*, Munchen, 1. and 2. Marz, 1990, CAB Abstract, 1990-91.
- Hinshaw, W.R. 1965. Diseases of the Turkey, In: Biester, H. F. and Schwarte, L. H. (eds), *Disease of poultry*, 5th edition, Iowa State university Press, Ames, pp. 1253-1263.
- Lloyd, S. 1983. Effect of pregnancy and lactation up on infection. *Veterinary Immunology Immunopathology*. 4: 153-176.
- Luna, L.G. 1968. *Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology*, 3rd edition, McGraw Hill Book Co. New York.
- McDougald, L.R. 1992. Other protozoan diseases in the intestinal tract, In: Hofstad, M. S. ed. *Diseases of Poultry*, 8th edition, Panima Educational Book Agency, New Delhi, India, pp.723-725.
- Mckeon, T., Dunsmore, J. and Raidal, S.R. 1997. *Trichomonas gallinae* in budgerigars and columbid birds in Perth, Western Australia, *Australian Veterinary Journal*, 75: 652-659.
- Mostafa, M.G. 1989. *Methods of statistics*, Fourth edition, Karim Press and Publications, Dhaka, pp. 296-298.
- Nasrin, M. 2004. Parasites of pigeon (*Columba livia*) in Mymensingh District, Bangladesh, MS Thesis in the Department of Parasitology, Bangladesh Agricultural University, Mymensingh.
- Perez Mesa, C., Stabler, R.M. and Berthrong, M. 1961. Histopathological changes in the domestic pigeon infected with *Trichomonas gallinae* (Jones's Barn Strain), *Avian Diseases*. 5: 48-60.
- Schlesselman, J.J. 1982. *Case-Control Studies*, Oxford University Press, New York, pp.174-177.
- Soulsby, E.J.L. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*, 7th edition, Bailliere Tindall and Cassel Ltd. London, pp.562-563.
- Stabler, R.M. 1947. *Trichomonas gallinae*, Pathogenic trichomonad of birds, *The Journal of Parasitology*, 33: 207-213.
- Stabler, R.M. and Herman, C.M. 1951. Upper digestive tract trichomoniasis in mourning doves and other birds, *Transactions of North American Wildlife Conference*, 16: 145-162.
- Tasca, T. and De Carli, G.A. 1999. Prevalence of *Trichomonas gallinae* from the upper digestive tract of the common pigeon (*Columba livia*) in the southern Brazilian state, Rio Grande do Sul, *Parasitologia al Dia*, 23: 42-43.
- Toro, H., Saucedo, C., Borie, C., Gough, R.E. and Alcaino, H. 1999. Health status of free living pigeons in the city of Santiago, *Avian Pathology*, 28: 619-623.