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High prevalence of *Trichomonas gallinae* in domestic pigeons (*Columba livia domestica*) in subtropical southern China

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Domestic pigeon (*Columba livia domestica*) as the main host of *Trichomonas gallinae* plays an important role in the spread of *T. gallinae*, but limited information about the prevalence of *T. gallinae* in domestic pigeons in China is available. In the present investigation, a total of 319 domestic pigeons on seven commercial farms in Guangdong Province, Southern China were examined microscopically in freshly prepared wet mount between July 2009 and January 2010. *T. gallinae* was observed in 108 out of 319 pigeons, giving an overall prevalence of 33.9%. Among these flocks in this survey, the positivity in different farms varied ranging from 23.7 to 45.1% with no significant difference ($\chi^2 = 5.602$, $P = 0.469$). However, significant difference in the prevalence of pigeons with different ages was observed ($\chi^2 = 11.59$, $P = 0.003$). The results of the present survey revealed high prevalence of *T. gallinae* infection in pigeons, and improved integrated strategies should be taken to control the spread of *T. gallinae* infection in pigeons in China.

Key words: *Trichomonas gallinae*, trichomonosis, pigeon, *Columba livia domestica* and prevalence, China.

INTRODUCTION

Trichomonas gallinae is a flagellated protozoan parasite which infects a wide scope of birds. Domestic pigeon (*Columba livia domestica*) as the main host of *T. gallinae* plays an important role in the spread of *T. gallinae* (Harmon et al., 1987). As the causative agent of avian trichomonosis, *T. gallinae* usually inhabits the upper gastrointestinal tract of different avian species, especially

the crop and esophagus, however, other organs, such as liver, bones, sinuses of the skull, lungs, air sacs, peritoneum and pancreas of birds can also be parasitized partly depending on the virulence of the *T. gallinae* strains (Honigberg et al., 1971; Narcisi et al., 1991). The clinical signs of birds infected by *T. gallinae* vary ranging from asymptomatic to death caused by regurgitation, anorexia, or respiratory failure due to large caseous lesions that block the lumen of respiratory tract (Baker, 1986; Narcisi et al., 1991; Burton et al., 2004; Lv, 2008). Because it causes high mortalities and great losses in birds, especially in columbiformes, *T. gallinae* is considered one

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Table 1. Prevalence of *Trichomonas gallinae* infection in domestic pigeons in subtropical Southern China.

Geographical location	Breeding birds	Nestlings	Adolescent birds	Total positivity
	Positive no. / examined no. / prevalence (%)	Positive no. / examined no. / prevalence (%)	Positive no. / examined no. / prevalence (%)	Positive no. / examined no. / prevalence (%)
Guangzhou	7/21/33.3	7/18/3.89	5/11/45.5	19/50/38
	2/16/12.5	5/19/26.3	11/15/73.3	18/50/36
	2/7/28.6	6/17/35.3	1/5/20	9/29/31
	4/14/28.6	4/13/30.8	13/21/61.9	21/48/43.8
Shenzhen	1/6/16.7	3/13/23.1	5/19/26.3	9/38/23.7
Zhuhai	1/12/8.3	11/27/40.7	6/13/46.2	18/52/34.6
Jiangmen	1/8/12.5	8/26/30.7	5/18/27.8	14/52/26.9
Total	18/84/21.4	44/133/33.1	46/102/45.1	108/319/33.9

of most serious pathogen in pigeons all over the world (Work and Hale, 1996; Forrester and Spalding, 2003; Villanúa et al., 2006).

In China, pigeon's meat is an important source of Chinese cuisine, and nearly 60 million pigeons are raised for human consumption every year, including 20 million pigeons reared in Guangdong Province, Southern China. Despite of its significance to health of columbiformes, limited information of the prevalence of *T. gallinae* infecting domestic pigeons is available all over the world including China, because there are only limited investigation of this pathogen affecting domestic pigeons reported (McKeon et al., 1997; Dovc et al., 2004; Padilla et al., 2004; Luo et al., 2006; Huang et al., 2009; Sansano-Maestre et al., 2009; Zhang, 2009). Although there are three documents about the prevalence of domestic pigeons infected by *T. gallinae* reported in different regions of China, unfortunately, they are published only in the Chinese language in local journals (Luo et al., 2006; Huang et al., 2009; Zhang, 2009). In view of this background, the aim of the present investigation was to estimate the prevalence of *T. gallinae* infection in pigeons reared on different

farms in China's subtropical Guangdong Province, which would provide essential data to formulate integrated strategies for control trichomonosis in domestic pigeons in China.

MATERIALS AND METHODS

The investigation sites

All of the pigeons for the present study were sourced from seven farms in the area of Pearl River Delta locating in the southeastern Guangdong Province, Southern China, which is one of most economically well-developed regions in China. This area is also the major base for raising pigeons. The climates of this region are subtropical with the average annual temperature 21~23°C and annual precipitation exceeds 1500 mm.

Sample collection

A total of 319 oropharyngeal swab samples taken from the mouth and crop of pigeons were obtained randomly from apparently healthy animals on seven representative commercial flocks in Guangdong Province between June 2009 and January 2010 (Table 1), following the standard procedures (Anderson et al., 2009). To analyze the risk factors associated with *T. gallinae* infection in domestic

pigeons, the farms surveyed in this study were divided into two groups according to level of the management and environmental sanitation (LMES); the doves were divided into three groups according their ages and usage: 98 breeding birds (> six month old), 102 adolescent birds (one month old to six months old) and 133 nestlings (< one month old). The birds in these farms are cage-raised and supplied with commercial complete feed and corn. These birds are mainly exported to Hong Kong and Macao for human consumption. The management data were obtained before collecting oral swab samples through personal interviews with the workers on these farms.

Laboratory techniques

The fresh saline smears (wet mounts) were examined using a light microscope at 400× magnification (Anderson et al., 2009). Trichomonads were identified if motile, flagellated protozoa were observed in the field of microscope (Dovc et al., 2004; Anderson et al., 2009).

Statistical analysis

The risk factors including ages of birds, LMES, and the period of sampling which may be associated with *T. gallinae* infection in domestic pigeons were performed using Chi Square Test in SPSS for Windows (Release 13.0 standard version, SPSS Inc., Chicago, USA).

Table 2. Risk factors associated with *Trichomonas gallinae* infection in domestic pigeons in subtropical southern China.

Variable		Examined no.	Positive no. / prevalence (%)	Pearson Chi-square value
Age	Breeding birds	84	18/21.4	11.59*
	Adolescent birds	102	46/45.1	
	Nestlings	133	44/33.1	
Period	Period 1 (July-August)	98	39/39.8	3.21
	Period 2 (September-November)	79	28/35.4	
	Period 3 (December-January of next year)	142	41/28.9	
LMES ^a	High	67	18/26.9	1.85
	Low	252	90/35.7	

^a represents level of the management and environmental sanitation on farms in this study. * represents $P < 0.05$.

RESULTS AND DISCUSSION

T. gallinae was observed in 108 out of 319 domestic pigeons microscopically in freshly prepared wet mount, thus the overall prevalence was 33.9%, and the prevalence in different farms varied ranging from 23.7 to 43.8%, which was not statistically significant among these farms (Table 1). There were no significant differences in the prevalence between the periods of sampling and the LMES, but significant difference was observed in the prevalence of *T. gallinae* infection in pigeons of different age groups ($\chi^2 = 11.59$, $P = 0.003$, Table 2).

Although *T. gallinae* is one of most severe pathogens for domestic pigeons, playing an important role in the transmission of *T. gallinae* (Harmon et al., 1987), only limited surveys of *T. gallinae* infection in domestic pigeons have been reported throughout the world (McKeon et al., 1997; Dovc et al., 2004; Padilla et al., 2004; Luo et al., 2006; Huang et al., 2009; Sansano-Maestre et al., 2009; Zhang, 2009). The prevalence of *T. gallinae* infection in pigeons (33.9%) in present study was considered higher compared to that found by Dovc et al. (2004), but lower than reported by other researchers (McKeon et al., 1997; Padilla et al., 2004; Luo et al., 2006; Villanúa et al., 2006; Huang et al., 2009; Sansano-Maestre et al., 2009; Zhang, 2009). The differences in prevalence of *T. gallinae* found in pigeons may due to the variations in seasons of sampling, age, animal husbandry practices in different regions, feed pattern of the birds and detection assay.

In the present study, the breeding birds had a lower prevalence of 21.4%, compared with adolescent birds (45.1%) and nestlings (33.1%). These results were consistent with the results of two previous surveys (Luo et al., 2006; Zhang, 2009), possibly because the breeding birds were nursed more carefully than other birds and partially protected by life-long persisting specific antibodies produced when they were infected by *T. gallinae*.

Conclusions

The results of the present study reveal high prevalence of *T. gallinae* infection in domestic pigeons in China's subtropical Guangdong Province, indicating that more attentions should be paid to control the spread of *T. gallinae* in domestic pigeons. Our results also provide foundational data for formulating integrated strategies such as improving animal welfare, and maintaining a good environmental sanitation on farms in China.

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