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Prevalence of coccidia in domestic pigeon (*Columba livia domestica*) of Assam, India

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Abstract

Coccidiosis caused by *Eimeria* sp. is a common parasitic disease causing a serious problem in pigeon. The present study was conducted for a period of one year from February 2015 to January 2016 in four districts of Assam namely Kamrup Metro, Kamrup Rural, Lakhimpur and Dhemaji to determine the prevalence of coccidia. A total of 438 pooled faecal samples were investigated with floatation method and prevalence rate was found to be 38.81%. Positive samples were sporulated by 2.5% potassium dichromate solution. Five species of coccidia under genus *Eimeria* were recorded. *Eimeria labbeana* (28.08%), *E. columbarum* (6.84%), *E. columbae* (2.86%) and another unidentified species of *Eimeria* (1.14%) having similarity with *E. duculai* and another unidentified species of *Isoospora* (0.22%). Seasonal prevalence was found highest in premonsoon season (61.22%) and least in winter (28.46%). Morphological differentiation of the *Eimeria* species was done by micrometry.

Keywords: Pigeon, prevalence, coccidia, Assam

Introduction

Coccidia are common protozoal pathogen in pigeons. These are found worldwide. Disease is mostly found in young birds especially where these are intensively reared and when hygienic status is poor. Older birds act as carrier and remain apparently healthy. A total of 16 *Eimeria* species have been identified from the family Columbidae and out of these only three species- *Eimeria columbae*, *E. columbarum* and *E. labbeana* are commonly reported with varying degree of virulence. Coccidiosis due to *Eimeria* sp. usually does not exhibit clear clinical manifestation. In young pigeons the disease is acute with loss of weight, excretion of blood streaked faeces and mortality ranging from 5% to 30% (Aleksandra and Pilarczyk, 2014) [1]. One infected pigeon may expel few to hundreds of millions of oocyst per day. The source of infection is faeces containing oocysts. Oocysts may also be found in water, litter and feed. Oocysts excreted in the faeces are not pathogenic, but in the loft with proper humidity and temperature they mature, become invasive and are able to infect birds. The aim of the present study was to estimate the prevalence of *Eimeria* sp. in pigeons of Assam.

Materials and Methods

A total of 438 pooled faecal samples/ droppings of pigeons collected from different households, market places and temple premises of the present study area were included to assess the prevalence of coccidia infection in domestic pigeon. About 5-10 g of each sample was collected in separate screw -capped vials with proper labeling and brought to the Parasitology laboratory. The faecal samples thus collected were examined either on the same day or stored in a refrigerator at 4°C for subsequent screening.

The faecal samples were first examined grossly to establish its consistency and colour and presence of mucus, blood etc. Subsequently, standard procedures were followed to determine the presence or absence of coccidia oocysts.

Floatation method was used to concentrate the coccidia oocysts using saturated sucrose solution (Sheather's solution, sp. gr. 1.12-1.30) as per standard procedure (Soulsby, 1982) [1].

Sporulation of coccidia oocyst

Faecal samples which were found positive for coccidia oocysts by floatation method were mixed with 2.5% potassium dichromate solution in medium sized petridishes and left at room temperature for sporulation of oocysts. Coccidia species were identified according to the size and morphological characteristics of the oocysts (the shape and colour of the oocysts);

thickness of the oocyst walls; presence of micropyle, cap, polar granules, oocyst or sporocysts deposits; size and shape of the sporocysts; shape of the Stieda bodies and of sporozoites etc.) and sporulation time. The identification of each species was made with reference to the measurements of 25 oocysts from at least 5 samples. Micrometry of oocyst of different coccidia species was done as per the procedure described by Sloss *et al.* (1994)^[10].

Results and Discussion

Gross examination of the faecal samples showed changes in colour and consistency of faecal samples such as mucus mixed faeces, greenish to whitish diarrhetic faeces and blood tinged droppings in few cases. Examination of pooled faecal samples by floatation method in the present study revealed the presence of unsporulated oocysts of coccidia.

In the present study, out of 438 samples screened for coccidia, 170 samples were positive with an overall prevalence of 38.81% which is in conformation with identical reports of workers from various countries (28.96% by Bandyopadhyay *et al.*, 2006^[2] from West Bengal; 35% by Sari *et al.*, 2008^[9] from Turkey; 35% by Mahdii and Al-Rubaie, 2013^[5] from Baghdad; 52% by Hui *et al.*, 2012^[4] from Shanghai).

Considering the micrometry and time variation during sporulation procedure five species of coccidia were identified in pigeons of Assam (Fig1.). Among the five species of genus *Eimeria*, oocysts of *Eimeria labbeana* was the most common and frequently detected with a prevalence of 28.08 % (123/438) (fig. 2). The oocysts were slightly spherical to subspherical. Twenty five oocysts were measured, size ranging from 19.50 -23.43 μm in length and 16.41- 19.03 μm in width. The average size was 21.02 x 17.98 μm . Their length-width ratio (shape index) ranged from 1 to 1.24 with a mean of 1.12. Oocyst wall composed of two layers was colourless or slightly yellowish brown about 1 μm thick, without any visible micropyle. An ovoid polar granule was present in the oocysts. The sporulation time of oocysts ranged from 24-36 hours. Similar morphological findings was reported by Pinto, 1928.

Prevalence of *Eimeria columbarum* was recorded 6.84% (30/438). The shape of the oocysts was spherical or subspherical and measured an average of 20.06 x 17.52 μm . The oocyst wall is double layered and micropyle is absent. An ovoid polar granule is present near one pole of the oocyst. Sporulation time varied from 36-40 hours. Similar result was reported by Nieschulz, 1935^[7].

Eimeria columbae 2.86% (11/438) was recorded with morphology of subspherical and smaller in size as compared to *E. labbeana* and *E. columbarum*. The average measurement

of oocyst was 16.4 x 14.3 μm without a micropyle. The oocyst wall is composed of two layers. The shape of the sporozoites was curved and the time of sporulation varied from 65-72 hours. Previously it was reported by Mitra and Dasgupta, 1937^[6].

Lowest prevalence of 1.14% (5/438) was recorded due to unidentified *Eimeria* sp. The oocysts were broadly ovoid with an inconspicuous micropyle at the narrower end. They were 29.6 (27.0-31.0) x 25.0 (23.0-27.0) μm in size, having a polar granule. The oocyst wall is composed of very thin double layers. The oocyst had a shape index of 1.26. The elongate sporocysts were 15.5 x 7.2 μm . The sporulation time was 36-48 hours. The oocyst of this unidentified species of *Eimeria* was the largest among all the *Eimeria* sp. identified in the present study resembling oocyst of *Eimeria duculai*, described by Varghese in 1980 from Torres Strait imperial pigeon and and Yang *et al.* (2016)^[13] from Australia.

Sporulated oocyst of *Isospora* sp. was observed in only 1 sample mixed with *E. labbeana*, the prevalence of infection being 0.22%. The sporulated oocyst of *Isospora* species was spherical and double walled. The average measurement of oocyst was 16.22 x 15.88 μm without a micropyle. The shape of the sporocysts was round with a mean size of 9.24 μm . Time of sporulation varied from 48-72 hours. Hui *et al.* (2012)^[4] also reported 5 species as *Eimeria labbeana*, *E. kapotei*, *E. duculai*, *E. columbae* and *E. columbarum* from Shanghai while Aleksandra and Pilarczyk (2014)^[1] isolated three species (*Eimeria labbeana*, *E. columbarum* and *E. columbae*) in mixed infection. Highest detection of *E. labbeana* was reported by several workers (Hui *et al.*, 2012; Mahdii and Al-Rubaie 2013; Aleksandra and Pilarczyk, 2014; Djelmoudi *et al.* 2014; Yang *et al.*, 2016)^[4, 1, 5, 3, 13] which is in accordance to our findings.

The seasonal prevalence of coccidia infection in pigeon on the basis of faecal examination is presented in the Table 2 and Fig.3. The Premonsoon season (March, April, May) had highest 61.22% prevalence rate while the infection recorded during the monsoon (June, July, August, September), post monsoon (October, November) and winter season (December, January, February) were 34.78%, 34.73% and 28.46% respectively. Infection due to coccidia was found throughout the year. Variation might be due to the climatic changes, rainfall and resultant humidity, habitat and stress condition of the bird. Literature on seasonal prevalence of coccidia infection in pigeon is sparse to compare our findings with those of other workers.

Statistical analysis by Chi square test revealed significant ($P < 0.05$) difference in prevalence of different species of *Eimeria* and *Isospora* and seasonal prevalence in season wise.

Table 1: Prevalence of coccidia infection in pigeons on the basis of faecal examination

Sample examined	Species of coccidia identified	No. positive	% positive	Chi-square value
438	<i>Eimeria columbarum</i>	30	6.84	35.7882*
	<i>Eimeria labbeana</i>	123	28.08	
	<i>Eimeria columbae</i>	11	2.86	
	<i>Eimeria</i> sp. (unidentified)	5	1.14	
	<i>Isospora</i> sp.	1	0.22	
Total 438		170	38.81	

*Significant ($P < 0.05$)

Table 2: Seasonal prevalence of coccidia infection in pigeon by faecal examination (N=438)

Month/season	Samples examined	Samples positive	% positive	Chi-square value
Premonsoon (March, April, May)	98	60	61.22	10.1882*
Monsoon (June, July, August, September)	115	40	34.78	
Post monsoon (October, November)	95	33	34.73	
Winter (December, January, February)	130	37	28.46	
Total	438	170	33.81	

* Significant ($P < 0.05$)

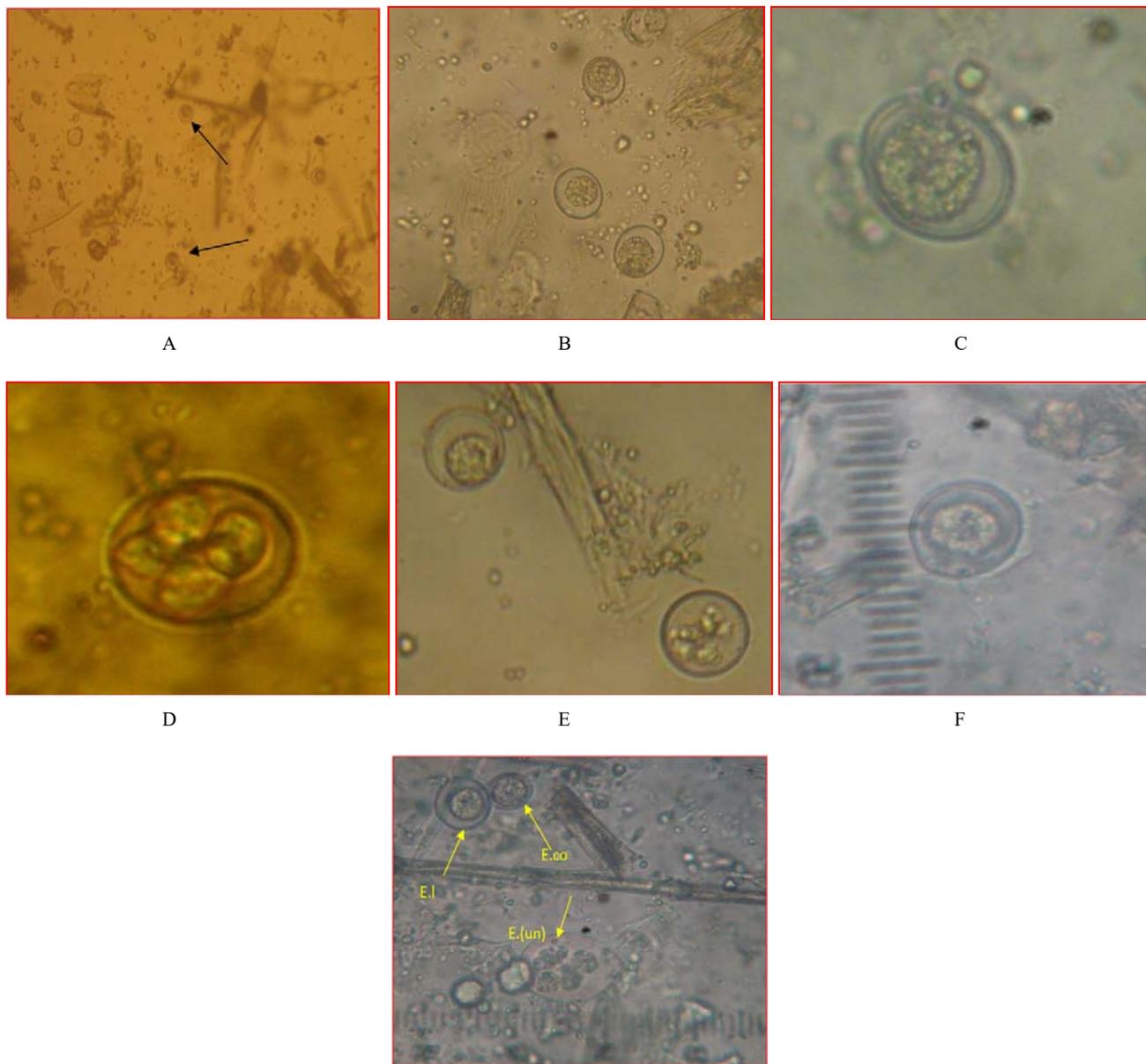


Fig. 1: (a) Unsporulated oocyst of coccidia,100X; (b)Unsporulated oocyst of coccidia 400X; (c, d) unsporulated and sporulated oocyst of *Eimeria labbeana* (E.l); (e,f) unsporulated and sporulated oocyst of (*E.co*) *Eimeria columbae* (400X); (g) (un): Sporulated unidentified *Eimeria* sp. [E.l: *Eimeria labbeana*, E.co : *Eimeria columbae* (400X)]

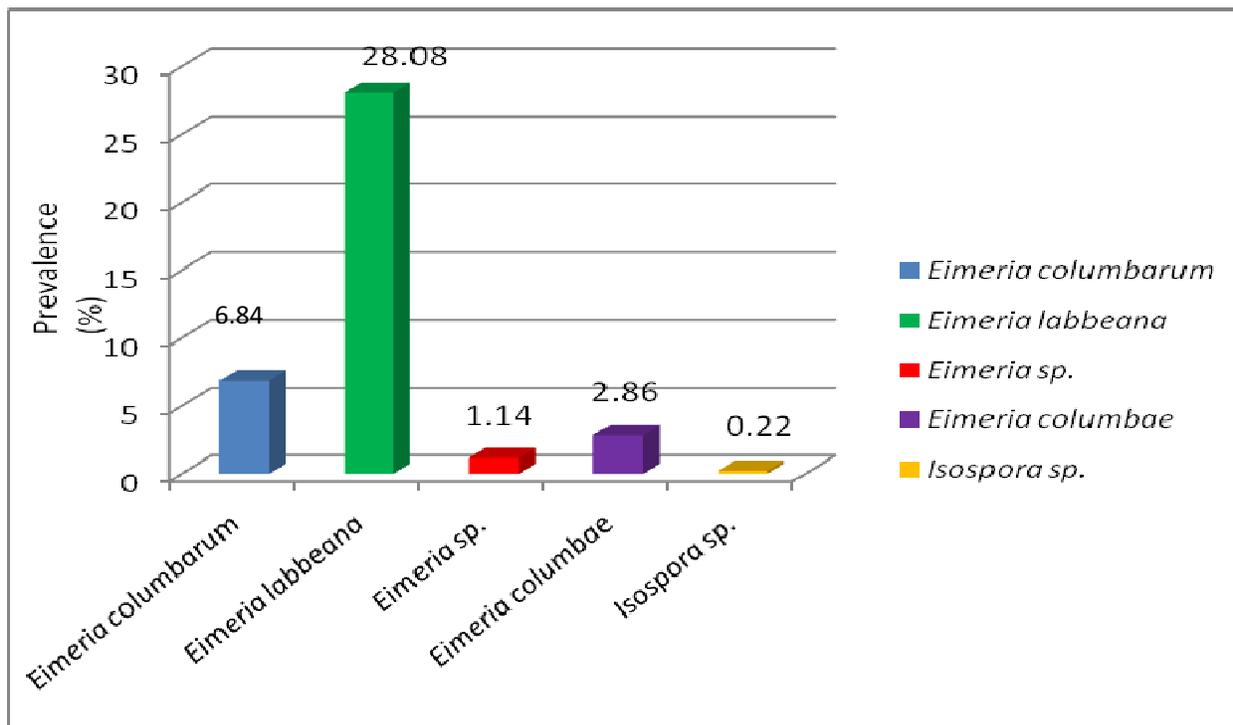


Fig 2: Prevalence of coccidia infection in pigeon

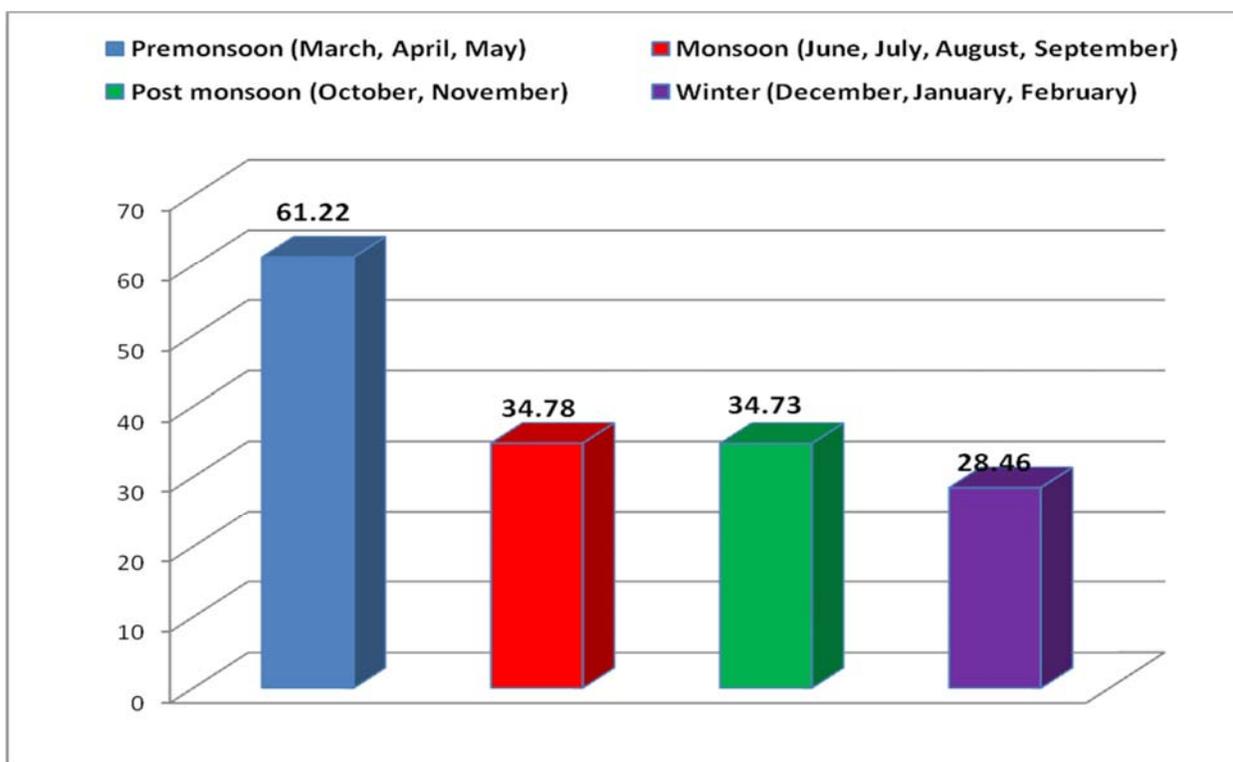


Fig 3: Seasonal prevalence of coccidia infection in pigeon by faecal examination

Summary and Conclusion

In the present investigation prevalence of coccidia was found to be 38.81%. Considering the micrometry and time variation during sporulation procedure five species of coccidia were identified in pigeons of Assam. Seasonal prevalence was found highest in premonsoon season. It should be considered that health improvement and hygienic maintenance are very important in obtaining more economic outcome from pigeon.

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