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Gastrointestinal parasitic infections in chickens of upper gangetic plains of India with special reference to poultry coccidiosis

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Abstract Studies on the prevalence of gastrointestinal parasites of chicken reared under backyard and intensive systems were carried out in two north Indian states viz., Uttar Pradesh and Uttarakhand. Out of 58 poultry farms screened for gastrointestinal parasites, 81.03 % were positive for *Eimeria* spp., 15.52 % for *Ascaridia galli,* 3.45 % for *Hetarakis gallinarum*, 1.72 % for *Syngamus trachea*, 5.17 % for *Capillaria* spp, 1.72 % for *Raillietina* spp., 1.72 % for *Trichostrongylus tenuis*, 1.72 % for *Choanotaenia infundibulum* and 1.72 % for *Strongyloides avium*. In broiler farms, the prevalence of *Eimeria* spp. was higher (88.24 %) as compared to layer farms (71.43 %) and backyard poultry (70 %). Identification of *Eimeria* spp. using COCCIMORPH software revealed prevalence of *E. acervulina, E. tenella, E. necatrix, E. mitis* and *E. praecox* in 94.3, 17.14, 31.44, 85.7 and 2.86 % farms, respectively. However, *E. maxima* and *E. brunetti* could not be identified in any of the farms using this software. The prevalence of helminthic infections was higher in poultry farms of Uttarakhand (40.0 %) as compared to Uttar Pradesh (11.62 %) with higher prevalence in backyard poultry (36.4 %), followed by layer farms (28.6 %) and lowest in broiler farms (9.1 %). *A. galli* was the most common G.I. helminth and it was recorded in free-range (backyard poultry) as well as intensive systems (broiler and layer farms).

Keywords Chicken · Gastrointestinal parasites · North India · Prevalence

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India is a livestock dependent country with the animal husbandry sector along with agriculture and fisheries contributing to 5.26 % of the total GDP (Anonymous 2009). Among the diverse animal husbandry practices, poultry farming is the least cost alternative next to fish rearing in the animal husbandry sector. India has one of the world's largest and fastest growing poultry industry, ranking third in hen egg production and sixth in broiler meat production (USDA 2011). Poultry sector plays an important role in the national and socio-economic development of the country contributing nearly $2.2 billion annually to the national economy (Mohanty and Rajendran 2003). However, the economics of poultry farming may be hampered by frequent outbreaks of diseases due to faulty management of the poultry farms. Of the various infectious diseases, parasitic infections may cause considerable damage and great economic loss to the poultry industry due to malnutrition, decreased feed conversion, weight loss, lowered egg production and death in young birds. The common internal parasitic infections occurring in poultry include cestodes, nematodes and coccidia, with mixed infections being very common (Poulsen et al. 2000). Coccidiosis, ranked second important disease of poultry after salmonellosis, is one of the most dreadful diseases, which affects all age groups while most of the helminthic infections are chronic in nature and affect mainly adult birds.

The prevalence of most of the parasitic diseases in poultry seems to have reduced significantly in commercial poultry production systems due to improved housing, hygiene and management (Permin and Hansen 1998). However, parasitic diseases continue to be of great importance in deep-litter and free-range systems of poultry rearing. The aim of the present study was to determine the prevalence of *Eimeria* spp. and gastrointestinal helminths

in intensive systems as well as free-range chickens in upper gangetic plains of India.

Materials and methods

A total of 58 farms from free-range (backyard poultry) as well as intensive system (broiler and layer farms) were sampled from six districts of Uttar Pradesh and Uttarakhand namely, Bareilly (17 broiler, 3 layer and 5 backyard), Lucknow (4 broiler and 1 backyard), Faizabad (4 broiler and 3 layer), Mathura (2 broiler, 3 layer and 1 backyard), Udham Singh Nagar (4 broiler, 3 layer and 2 backyard) and Dehradun (3 broiler, 2 layer and 1 backyard) during November 2011–April 2012.

Pooled poultry droppings were collected in 50 ml polypropylene conical tubes containing 5 ml of 2 % potassium dichromate from individual farms starting from one corner of the unit and moving in a 'W-shaped' path across the unit, till the tube was filled up to the 10 ml mark. The samples thus collected were transported to the laboratory and kept in refrigerator at 4 °C until further used.

All these samples were screened for coccidian oocysts and helminth eggs by standard salt flotation technique. Oocysts per gram of faeces were determined using McMaster chambers.

For the identification of eimerian oocysts, the photographs of representative numbers of individual sporulated oocysts from each sample were taken at 40× high dry power objective with a photomicrographic camera attached to a trinocular research microscope. The identification of *Eimeria* spp. of chickens was done by using COCCIMORPH software (a system for Automatic Diagnosis of Coccidia through Morphological Analysis; http://www.coccidia.icb.usp.br/coccimorph/). The software was downloaded from the internet and the oocyst images (400×) were uploaded for species identification. The *Eimeria* spp. identified by the software in each sample was recorded.

Result and discussion

Out of 58 poultry farms screened, 81.03 % were positive for *Eimeria* spp. oocysts, 15.52 % for *Ascaridia galli,* 3.45 % for *Hetarakis gallinarum*, 1.72 % for *Syngamus trachea*, 5.17 % for *Capillaria* spp., 1.72 % for *Raillietina* spp., 1.72 % for *Trichostrongylus tenuis*, 1.72 % for *Choanotaenia infundibulum* and 1.72 % for *Strongyloides avium* eggs (Table 1; Plate 1).

An overall prevalence of 81.03 % of *Eimeria* spp. infection with a mean OPG of 28044.22 ± 6354.46 (Mean ± S.E.) was recorded in chickens in the areas under study. Higher prevalence of infection in chicken was recorded in Uttar Pradesh (83.72 %) than in Uttarakhand (73.33 %). In U.P., the prevalence of infection was highest in district Bareilly (88.0 %), while it was lowest in district Mathura (66.7 %). In Uttarakhand, the prevalence was higher in district Udham Singh Nagar (88.9 %) as compared to Dehradun (50.0 %). The prevalence in chickens reared under different poultry farming systems is shown in Table 2. It was higher in broiler farms (88.24 %) as compared to layer farms (71.43 %) and backyard poultry (70 %). Mean OPG was highest in broiler farms (40922.79 ± 56235.14) and lowest in backyard poultry (3231.43 ± 3616.55). Depending on the type of poultry

Table 1 Prevalence of gastrointestinal parasitic infections in poultry farms of upper gangetic plains of India

Parasite-species	Uttar Pradesh				Uttarakhand				Overall percent prevalence ($n = 58$)
	Broiler farms ($n = 27$)	Layer farms ($n = 9$)	Backyard units ($n = 7$)	% prevalence ($n = 43$)	Broiler farms ($n = 7$)	Layer farms ($n = 5$)	Backyard units ($n = 3$)	% prevalence ($n = 15$)	
Eimeria spp.	24	7	5	83.72	6	3	2	73.33	81.03
Ascaridia galli	1	1	3	11.62	2	2	0	26.67	15.52
Capillaria spp.	0	0	0	0	1	2	0	20	5.17
Hetarakis gallinarum	0	1	0	2.3	0	1	0	6.67	3.45
Syngamus trachea	0	1	0	2.3	0	0	0	0	1.72
Choanotaenia infundibulum	0	0	0	0	0	1	0	6.67	1.72
Raillietina spp.	0	0		0	0	0	1	6.67	1.72
Strongyloides avium	0	0	0	0	1	0	0	6.67	1.72
Trichostrongylus tenuis	0	1	0	2.3	0	0	0	0	1.72

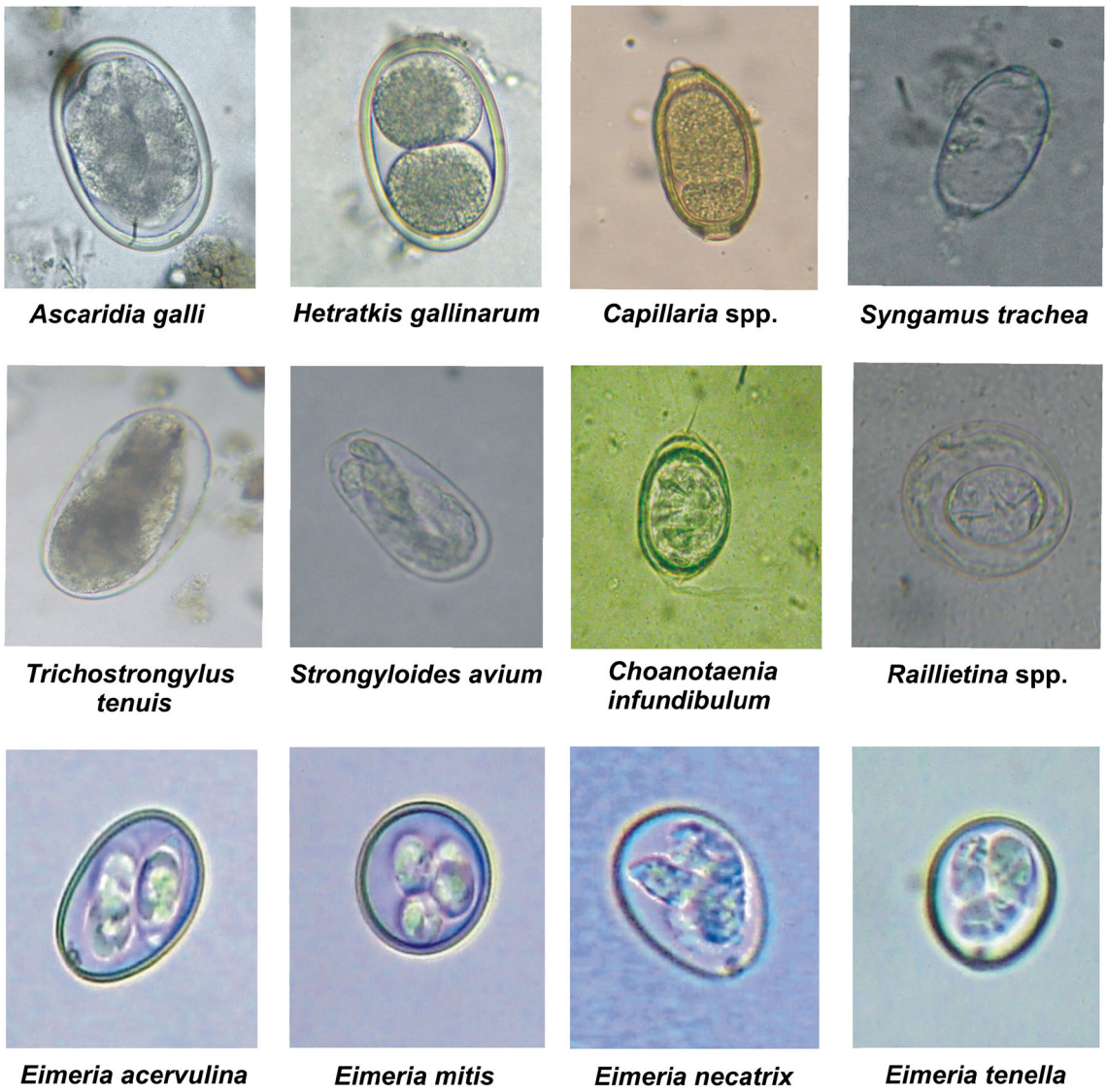

Plate 1 Eggs/oocysts of gastrointestinal parasites identified in poultry droppings collected from different poultry farms

Table 2 Prevalence of coccidian oocysts in different poultry farming systems of UP and Uttarakhand

Farming system	No. of farms screened	No. positive (% +ve)	Mean OPG ± S.E.	OPG range
Broiler	34	30 (88.24 %)	40922.79 ± 9644.17	160–2,42,541
Layer	14	10 (71.43 %)	8112.4 ± 5382.71	78–65,079
Backyard	10	7 (70 %)	3231.43 ± 1143.75	200–8,611
Total	58	47(81.03 %)	28044.22 ± 6354.46	78–2,42,541

production systems, managemental practices, age of birds and climatic conditions, variable prevalence rates of poultry coccidiosis has been reported from various parts of the world including India (Panda *et al.* 1997; Rana and Tikaram 1999; Jithendran 2001; Al-Natour and Suleiman 2002; Etuk et al. 2004; Ashenafi et al. 2004; Lobago et al. 2005; Khan et al. 2006; Muazu et al. 2008; Nematollahi et al. 2009; Saira Banu et al. 2009; Balasubramaniam and Dorairajan 2009). Contrary to the findings of present study, Saira Banu et al. (2009) reported a moderate prevalence rate in broiler farms (52.1 %), and higher prevalence in layer farms (61.7 %) of Tamil Nadu, India. Higher prevalence of coccidia in layer farms may be because of faulty managerial practices or high density of birds in cages.

Identification of species of *Eimeria* oocysts by COCCIMORPH software revealed that overall prevalence of

Table 3 Prevalence of *Eimeria* spp. of chicken using COCCIMORPH software

Farming system	No. of farms screened	No. positive (% +Ve)						
		Ac	Tn	Nx	Mt	Mx	Pr	Br
Broiler	34	28	7	9	26	0	1	0
Layer	14	10	0	3	8	0	0	0
Backyard	10	7	0	4	7	0	0	0
Overall prevalence (% prevalence)	58	45 (77.6)	7 (12.1)	16 (27.6)	41 (70.7)	0 (0)	1 (1.7)	0 (0)

Ac E. acervulina, *Tn E. tenella*, *Nx E. Necatrix*, *Mt E. mitis*, *Mx E. maxima*, *Pr E. praecox*, *Br E. brunetti)*

Eimeria acervulina, *E. tenella*, *E. necatrix*, *E. mitis* and *E. praecox* was 77.6, 12.1, 27.6, 70.7, 1.7 %, respectively (Table 3). However, *E. maxima* and *E. brunetti* could not be identified in any of the farms. In broilers, *E. acervulina* (82.4 %), *E. tenella* (20.6 %), *E. necatrix* (26.5 %), *E. mitis* (76.5 %) and *E. praecox* (2.9 %) could be identified, while in layers and backyard poultry only *E. acervulina*, *E. necatrix* and *E. mitis* could be identified. Identification of *Eimeria* species can be done by either conventional method or by biochemical and molecular techniques. Conventional methods are tedious, time consuming and needs expertise. An innovative approach that has been tried for identification of eimerian oocysts is a software tool COCCIMORPH (a system for Automatic Diagnosis of Coccidia through Morphological Analysis). In this, digital images from unidentified sporulated oocysts of *Eimeria* spp. are uploaded and the software analyses the oocyst on the basis of different features namely, curvature characterization, size and symmetry and internal structure characterization for the identification of species of eimerian oocyst (Castanon et al. 2007). In the present study, an attempt was made to use COCCIMORPH software for the identification of oocyst of *Eimeria* spp. The data on the use of this software for identification of *Eimeria* spp. is not available and our results show that this method of identification of oocysts has low specificity as many of the oocysts that were microscopically identified on the basis of their size and morphology could not be correctly identified by this software. This was further substantiated by the results of ITS-1 based nested PCR (Lew et al. 2003) which could identify *E. acervulina*, *E. tenella*, *E. necatrix*, *E. mitis*, *E. maxima*, *E. praecox* and *E. brunetti* in 94.3, 97.2, 68.6, 94.3, 88.6, 80, and 11.4 % farms, respectively (details not presented in this paper). Thus, it is opined that COCCIMORPH may only be used for preliminary screening/identification purposes only.

In the present study, the prevalence of helminth infection was higher in poultry farms of Uttarakhand (40.0 %) as compared to Uttar Pradesh (11.62 %). Also, the prevalence of helminthic infections was highest in backyard poultry (36.4 %), followed by layer farms (28.6 %) and broiler farms (9.1 %). Round worm infection was recorded in 15.5 % farms while tapeworm infection was recorded in 3.4 % farms screened. Mixed infections of nematodes were recorded in 8.6 % poultry farms screened, while *A. galli* infection was recorded in 6.9 % farms only. Higher prevalence of G.I. helminths in backyard poultry is expected as the birds are reared for longer duration and are allowed for scavenging for most of the days, and thus are more frequently exposed to infective stages/infected intermediate hosts of the helminths. In Uttar Pradesh, *A. galli* was the most common G.I. helminth and it was recorded from free-range (backyard poultry) as well as intensive systems (broiler and layer farms) of poultry rearing. However, *H. gallinarum*, *S. trachea* and *T. tenuis* could be recorded only from layer farms of U.P. In Uttarkhand, eggs of *A. galli, H. gallinarum*, *Capillaria* spp, *Raillietina* spp., *T. tenuis*, *C. infundibulum* and *S. avium* could be recorded. Puttalakshmamma et al. (2008) recorded 52.2 % cestode, 34.3 % nematode and 18.3 % mixed infection of cestodes and nematodes in fowl in and around Bangalore. They also reported prevalence of *A. galli, Rallietina tetragona*, *R. echinobothrida*, *H. gallinarum*, *Subulura* spp. and S. *avium* in the birds screened on post mortem examination. Katoch et al. (2012) also reported high prevalence of helminths in poultry (72.0 %) and *A. galli* was most prevalent, followed by *H. gallinarum*, *R. cesticillus*, *R. echinobothrida*, *H. gallinarum* and *Capillaria* spp. Mild infection of helminths often goes unnoticed but occasionally may accentuate heavy burden leading to reduced egg production, feed conversion and occasional mortality. Thus, continuous surveillance and systematic deworming is essential for profitable poultry rearing.

On the basis of findings of the present study, it is concluded that gastrointestinal parasitic infections, especially poultry coccidiosis, still remain as a major hurdle against profitable poultry production in poultry producing belts of north India and necessary preventive and control measures should be implemented strictly by poultry producers of these states.

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