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Protistology

Eimeria indiana (Apicomplexa, Sporozoea), a new eimerian species from the hen, *Gallus gallus domesticus* (Aves, Phasianidae), in India

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Summary

Twenty-five out of eighty (31.25%) hens, *Gallus gallus domesticus* L., had oocysts of an *Eimeria* species described here as a new species, *Eimeria indiana*. Mature oocysts are egg-shaped or ellipsoidal, measuring 23.45 μm(20.88-25.2) × 18.74 μm(16.2-21.6); the shape index (length/width) is 1.25. The oocyst wall (1.08 μm) is bi-layered and both the layers exhibit smooth surface. A prominent oval polar granule is present but there is no micropyle or oocyst residuum. Sporocysts, four in number, are ovoid to elongated, measuring 10.26 μm (6.4-10.8) × 5.83 μm (4.6-7.2); the shape index is 1.75. A steida body is present in each of the four sporocysts. Sporocyst residuum is present in the form of uniform granules scattered randomly. Sporozoites measuring 7.2 × 3.6 μm are crescent or banana shaped, lying length-wise in head to tail pattern.

Key words: Coccidia, poultry, hen, *Eimeria indiana* sp. nov., Gangetic Bengal, India

Introduction

The ancestors of the hen originated in Southeast Asia and have been extensively bred for size, colour patterns, conformation and egg laying ability during a long history of domestication (Banerjee, 1991). Unfortunately, these birds are subject to a malady, coccidiosis, recognized as the parasitic disease with the greatest impact on poultry production. It is caused by protozoa of the genus *Eimeria*, which parasitize the intestinal mucosa of the chicken. The coccidia of *Gallus domesticus* are responsible for the most important economical losses in poultry farming (Pellerdy, 1974). In the hen, *Gallus gallus domesticus* L., nine species of Eimeria have so far been described from India (Mandal, 1987). Amoud (1997) described two new species of *Eimeria* in local chickens from Saudi Arabia. Different species tend to develop in different parts of the chicken gut and may be identified by the nature and location of the lesions they cause during multiplication (Long et al., 1976).

During a survey of coccidian parasites, carried out in Gangetic Bengal, India, we found a new species of *Eimeria* in the feces of the hen. This species is described in the present paper.

Material and Methods

Fecal samples were collected immediately after defecation from eighty adult hens and mixed with 2.5% potassium bichromate ($K_2Cr_2O_7$) solution. For sporulation, samples were kept in a Petri dish in 2.5% potassium dichromate at room temperature. The samples were examined microscopically after flotation, using Sheather's sugar solution. Observations focused largely on sporulated oocysts. Photomicrographs were obtained using a phase contrast microscope (Olympus, CX41) and an Olympus digital camera (Model no. C-5060, 4× wide zoom lens). Twenty-five oocysts were measured and compared to those of *Eimeria* spp. previously reported in the hen in India. All measurements and means are in μm, with the range given in parentheses followed by the shape index (length/width ratio).

Results

Of eighty adult individuals of *Gallus gallus domesticus* examined, twenty-five (31.25%) had coccidian oocysts. A morphological comparison of these species revealed differences between them and those of other *Eimeria* spp. from *Gallus gallus domesticus*, as described below.

***Eimeria indiana* sp. n.** (Figs 1 and 2, Table 1).

Oocysts are egg-shaped or ellipsoidal, length 23.45 μm (20.88-25.2) and width 18.74 μm (16.2-21.6), the shape index (length/width) is 1.25; The oocyst wall is bilayered, with a uniform thickness (1.08 μm) and a smooth texture. One prominent oval polar granule is present, but micropyle and oocyst residuums are absent. Sporocysts, four in number, are ovoid to elongated, measuring 10.26 μm (6.4-10.8) × 5.83 μm (4.6-7.2); the shape index is 1.75. A steida body is present in each of the four sporocysts. Sporocyst residuum is present in the form of uniform granules scattered randomly. Sporozoites measuring 7.2 × 3.6 mm are crescent or banana shaped, lying length-wise in head to tail pattern (Figs 1 and 2).

Type host: hen, *Gallus gallus domesticus* L. (Aves, Phasianidae).

Type location: Gangetic Bengal, India.

Prevalence: 25 out of 80 (31.25%) hens examined were infected.

Site of infection: unknown, oocysts collected directly from host feces.

Time of sporulation: 48 hrs at room temperature.

Type specimen: The syntype no. DF/CO/07/05 deposited in the Department of Zoology, University of Kalyani, Kalyani.

Etymology: The epithet '*indiana*' has been given after the name of the country, 'India', where the species was discovered.

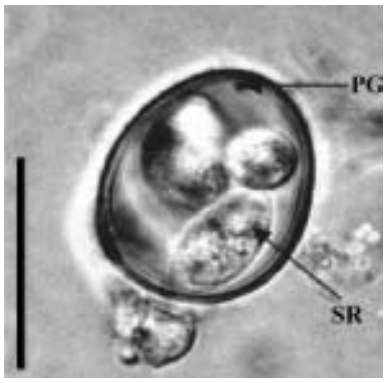

Fig. 1. Photomicrograph of sporulated typical oocyst of *Eimeria indiana* sp. n. showing the polar granule (PG) and sporocyst residuum (SR). Scale bar: 20 μm.

Fig. 1. Composite line drawing of a sporulated oocyst of *Eimeria indiana* sp. n. Scale bar: 20 μm.

Discussion

Among the nine accepted species of *Eimeria* from fowl (Mandal, 1987) from India, the present species resembles *E. tenella* (Railliet and Lucet, 1891) when dimensions of the oocyst and sporocyst along with shape of the sporozoite are considered. These two species are also closely related with respect to the presence of the polar granule, the steida body and the absence of oocyst residuum. But we can differentiate them on the basis of a very significant morphological character, i.e. absence of micropyle in our species and its presence in *E. tenella* (Mandal, 1987). Also, sporocyst residuum is present in the species described but absent in *E. tenella*. Among other species, *E. maxima* (Tyzzer, 1929) is comparatively larger in dimensions than the present species, while *E. necatrix* (Jhonson, 1930), *E. brunetti* (Levine, 1942), *E. mitis* (Tyzzer, 1929), *E. mivati* (Edger and Seibold, 1964), *E. praecox* (Jhonson, 1930), *E.*

Table 1. Comparative studies of *Eimeria indiana* sp. n. along with its related species.

Name	Author	Shape of the oocyst	Measurement (µm)	Thickness of oocyst wall (µm)	Micropyle	Polar granule	Oocyst residuum	Shape of the sporocyst	Measurement (µm)	Steida body	Sporocyst residuum	Sporulation time	Shape of the sporozoite	Measurement (µm)
E. tenella	Raillet and Lucet, 1891	Broadly ovoid	19.2-26.0 x 16.0-22.0	1.5	+	+	—	*	11.0 x 7.0	+	—	48 hrs	Banana shaped	8.0 x 6.0
E. maxima	Tyzzer, 1929	Ovoid or egg-shaped	27.0-34.0 x 16.0-28.0	1.3	*	+	—	Ovoid	15.0-20.0 x 8.0-9.0	+	*	48 hrs	Elongated	15.0 x 4.0
E. necatrix	Jhonson, 1930	Broadly ovoid	15.5-23.3 x 13.6-20.0	*	—	+	—	Elongated	10.6 x 6.0	*	*	48 hrs	*	*
E. brunetti	Levine,1942	Oval	24.0-30.0 x 20.0-23.0	*	*	+	—	*	11.0-16.0 × 5.0-10.0	*	*	24-48 hrs	*	*
E. mitis	Tyzzer, 1929	Spherical	12.3-20.7 x 10.7-19.2	*	_	+	—	Ovoid	9.0-10.0 x 6.5	+	+	48 hrs	*	*
E. mivati	Edger and Seibold, 1964	Ellipsoidal or ovoid	10.7-20.0 x 10.1-15.3	*	+	+	*	*	7.3-12.1 x 5.0-6.1	+	+	12 hrs or more	Crescent or banana shaped	11.1-13.0 x 1.9-2.5
E. praecox	Jhonson, 1930	Spherical to elliptical	17.7-24.4 x 13.8-19.2	0.72	+	+	—	Elongated to ovoid	*	*	*	48 hrs	*	*
E. acervulina	Tyzzer, 1929	Egg-shaped or oval	17.7-20.0 x 13.7-16.3	*	+	+	_	*	*	*	*	24 hrs	*	*
E. hagani	Levine,1938	Broadly ovoid	15.8-20.9 x 14.3-19.5	*	—	+	*	*	*	*	*	24-48 hrs	*	*
E. indiana	Present study	Egg-shaped or ellipsoidal	20.8-25.2 x 16.2-21.6	1.08	—	+	—	Elongated to ovoid	6.4-10.8 x 4.6-7.2	+	+	48 hrs	Crescent or banana shaped	7.2 x 3.6

Legends: + = present, — = absent, * = data not available

acervulina (Tyzzer, 1929), *E. hagani* (Levine, 1938) are comparatively smaller than the present one when dimensions of different parts are considered. *Eimeria jeddahensis* and *Eimeria waeli* described by Amoud (1997) from local chicken in Saudi Arabia also differ from the presently described species in the presence of micropyle and are comparatively larger, considering dimensions of different parts. On the basis on these characteristics, we consider the species described here to be a new coccidian, for which the name *E. indiana* is proposed.

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