Sporulation dynamics of poultry *Eimeria* oocysts in Chennai

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Abstract The infective form of *Eimeria* is the highly resistant oocyst, which is shed in the faeces of infected animals. Present study was carried out to understand the sporulation dynamics of six *Eimeria* oocysts viz. *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix* and *E. tenella* in Chennai. Faecal samples of poultry were collected from various poultry farms located in and around Tamil Nadu. Oocysts of various *Eimeria* species were examined microscopically for sporulation on a 6 h interval basis till complete sporulation is achieved. The sporulation time recorded was 168, 120, 216, 192, 96 and 96 h for *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix* and *E. tenella* respectively. It can be concluded on comparison with previous studies that humid weather conditions delay the sporulation time and dry weather and wet litter is the ideal condition for rapid sporulation.

Keywords Poultry faecal samples · Oocyst · Sporulation time · *Eimeria*

Introduction

Coccidiosis is one of the most prevalent disease in poultry caused by an intestinal protozoan parasite belonging to the

genus *Eimeria*. Although much work has been done on the biology of the eimerian coccidia, the dynamics involved in the survival and transmission of the parasites are not yet fully understood (Williams 1995).

The infective form of *Eimeria* is the highly resistant oocyst, which is shed in the faeces of infected animals. The oocyst is excreted in the poultry droppings as an unsporulated oocyst and in order to become infective it must sporulate. During sporulation four sporocysts, each containing two sporozoites, are formed within the oocyst. Sporulation of the oocyst depends mainly on three basic factors; temperature, humidity, and access to oxygen (Kheysin 1972).

Under ideal conditions, sporulation occurs in 24–48 h for most poultry eimerian species (Edgar 1955). The degree and rate of sporulation of excreted oocysts are important factors affecting the infection pressure in a flock of birds, thus influencing the epidemiology of the infections.

It is generally believed that moist litter will favour the development of coccidiosis, because of the higher sporulation ability thus induced (Card and Nesheim 1972; Matter 1989). Graat et al. (1994) studied the sporulation of oocysts of *Eimeria acervulina* in dry and clammy litter with different combinations of temperature and relative humidity and found only a slight difference in sporulation rates with changes in temperature and relative humidity. The maximum proportion of oocysts of *E. acervulina* that sporulated did not vary with temperature or relative humidity. Later, Waldenstedt et al. (2001) reported that sporulation is not favored by moist litter.

The aim of the present study was to assess sporulation time of six *Eimeria* oocysts viz. *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix* and *E. tenella* at Chennai with room temperatures ranging from 32 to 39 °C and relative humidity from 65 to 75 °C in the months of

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Fig. 1 Sporulated oocyst of *E. acervulina*

February–August 2009 (based on 2009 Chennai Meteorological dept. Data).

Materials and methods

The faecal samples of poultry were collected from various poultry farms located in and around Tamil Nadu. They were homogenized, mixed with 2.5 % potassium dichromate and sieved through 1 mm sieve to remove the coarse debris usually present in poultry droppings. The filtrate was kept in wide mouth containers with constant aeration to allow 90 per cent sporulation of oocysts. Oocysts of various *Eimeria* species were examined microscopically for sporulation on a 6 h interval basis until complete sporulation is achieved. The potassium dichromate solution should not be allowed to dry up or crystalize and 2.5 % solution should be added at frequent intervals. After sufficient sporulation the samples were transferred to sample containers—50 ml (Tarsons, India) and stored at 4 °C for further processing later identified by morphometry and PCR (Venkateswara Rao et al. 2012a, b).

Results and discussion

In the present study, the sporulation dynamics varied with various *Eimeria* species viz. *E. acervulina*, *E. brunetti*, *E. maxima*, *E. mitis*, *E. necatrix* and *E. tenella* (Fig. 1, 2, 3, 4, 5, 6). The sporulation time varied with a maximum of 216 h for *E. maxima* and a minimum of 96 h for *E. tenella* and *E. necatrix*. The samples were kept in wide mouth containers with constant aeration until 90 per cent sporulation took place (Table 1).

The sporulation time observed for various *Eimeria* species in the present study is on the higher side when

Fig. 2 Sporulated oocyst of *E. brunetti*

Fig. 3 Sporulated oocyst of *E. maxima*

Fig. 4 Sporulated oocyst of *E. mitis*

Fig. 5 Sporulated oocyst of *E. necatrix*

Fig. 6 Sporulated oocyst of *E. tenella*

Table 1 Mean sporulation time of oocysts of different *Eimeria* species

S. No.	<i>Eimeria</i> species	Mean 90 % oocysts sporulation time (h)	Oocysts sporulation time (h) (Levine 1985)
1	<i>E. acervulina</i>	168	24
2	<i>E. brunetti</i>	120	48
3	<i>E. maxima</i>	216	48
4	<i>E. mitis</i>	192	48
5	<i>E. necatrix</i>	96	48
6	<i>E. tenella</i>	96	48

compared Levine (1985) and AbdulBasith et al. (1995). The sporulation time taken by oocysts of *E. maxima* is more when compared to other *Eimeria* species. *E. tenella* and *E. necatrix* have the least sporulation time among other *Eimeria* species (AbdulBasith et al. 1995).

These findings are not in agreement with Levine (1985) and AbdulBasith et al. (1995) who reported a lesser time

required for sporulation of oocysts. AbdulBasith et al. (1995) reported an average sporulation time for *E. necatrix*, *E. brunetti* and *E. mitis* as 24, 36 and 30 h. respectively. The reason could be that the above studies might have been conducted in drier regions. This study was carried on in Chennai, a coastal city with high relative humidity up to 75 %. Since high moisture content in the environment does not favour sporulation (Waldenstedt et al. 2001), who reported that Sporulation of *E. maxima* was most efficient under dry conditions (16 % moisture content), and poorest in the samples with the highest moisture content (62 %). But the present study indicated that *E. necatrix* had the least sporulation time in concordance with the observations by AbdulBasith et al. (1995).

Hence it can be concluded that moist weather conditions delay the sporulation time and dry weather and wet litter is the ideal condition for rapid sporulation.

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Disclosure None

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