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Isospora heydorni isolated in Brazil: Infectivity to cattle

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Abstract

Infectivity to cattle of *Isospora heydorni*-like coccidium isolated in Brazil was studied. Two 10-month-old Holstein calves were inoculated orally with 1.7×10^7 oocysts, and were killed at 43 and 53 days PI. When their brain, small intestine, striated muscles or visceral organs (liver and mesenteric lymph nodes) were fed to each dog, all recipients began to shed fresh oocysts between 6 and 9 days after feeding. These results show that this coccidium infects cattle and may take them as one of the intermediate hosts. The other various characteristics of this coccidium were also similar to those of *I. heydorni* reported previously. Thus, we confirmed clearly that the present species and *I. heydorni* were the same species. Moreover, the shedding of oocysts by the dogs after feeding of each of various organs from the infected cattle indicated that the organisms would parasitize the various organs when they infected cattle.

Key words: *Isospora heydorni, Hammondia heydorni, Isospora bigemina,* Infectivity, Cattle, Extra-intestinal stages

Introduction

Isospora heydorni is one of the intestinal coccidia of dogs. Heydorn (1973) and Dubey and Fayer (1976) have reported that the life cycle is an obligatory heteroxenous, and cattle play a role as intermediate hosts. Although the endogenous stages of this parasite have been observed in the intestine of dogs (Heydorn *et al.*, 1975; Dubey and Fayer, 1976), the tissue stages in the intermediate host have not yet been clarified.

We had a chance of isolating *I. heydorni*-like oocysts from a dog in Brazil and reported that the various characteristics of this coccidium were similar to those of *I. heydorni,* and guinea pigs were found to be suitable intermediate hosts (Matsui *et al.*, 1981, 1986). In order to determine whether the present coccidium and *I. heydorni* were the same species, the infectivity of this parasite to cattle was examined.

Materials and Methods

Isospora heydorni-*like oocysts*

The oocysts used were first isolated from feces of a naturally infected dog in Brazil and were then transferred to guinea pigs and dogs to multiply as described in the previous paper (Matsui *et al.*, 1981).

Animals

Two 10-month-old Holstein female calves were used as experimental animals. Six puppies weighing 2800 ~ 5750 g were used as definitive hosts. The feces of all the puppies were examined by the sugar flotation method (specific gravity of sugar, 1.266) prior to experimentations.

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Microscopic examination

Each calf was inoculated orally with 1.7 x 10^7 sporulated oocysts and was killed at 43 and 53 days PI, respectively. The brain, diaphragm, heart, mesenteric lymph nodes and mucous membrane of the small intestine were examined for the coccidian parasite by the same methods described in the previous paper (Matsui *et al.*, 1986).

Ingestive examination

Various organs of these calves were separated and fed to puppies. The brain, small intestine, striated muscles (diaphragm and heart) or visceral organs (liver and mesenteric lymph nodes) of the calf killed at 43 days PI and the brain or striated muscles of the calf killed at 53 days PI were fed to each puppy. The recipients were examined daily for oocyst discharge by the sugar flotation method.

Results

Microscopic examination

When the calves were killed at 43 and 53 days PI, no parasites were detected microscopically in the brain, diaphragm, heart, mesenteric lymph nodes and mucous membrane of the small intestine.

Ingestive examination

The results are summarized in Table 1. When the brain, small intestine, striated muscles or visceral organs of the calf killed at 43 days PI were fed to each puppy, all recipients began to shed oocysts between 6 and 9 days after feeding. The puppies fed the brain or striated muscles of the calf killed at 53 days PI began to shed oocysts 6 days later. The number of oocysts per gram (OPG) was counted through the patent period (Fig. 1). Their maximum OPG values were in a range of 9.4 x 10^6 ~ 3.2 x 10^7.

Discussion

Cattle were first reported as an intermediate host of *I. heydorni* by Heydorn (1973) and Dubey and Fayer (1976). Following that, *I. heydorni*-like coccidium was isolated from several ruminants as the intermediate hosts (Dissanaike and Kan, 1977; Dubey and Williams, 1980; Warrag and Hussein, 1983; Nassar *et al.*, 1983). On the other hand, this parasite did not experimentally infect mice and rabbits (Heydorn, 1973; Dubey and Fayer, 1976). Thus, it has been recognized that *I. heydorni* is a coccidium of ruminants and dogs. However, many kinds of animals have been known as intermediate hosts of each isosporan coccidium.

I. heydorni-like oocysts isolated by us from a dog in Brazil showed the infectivity to guinea pigs, although mice, rats, hamsters and rabbits were refractory (Matsui *et al.*, 1981). This coccidium had very similar characteristics to

Table 1 Shedding of oocysts by dogs after ingestion of various organs from cattle inoculated with *I. heydorni* oocysts

Calf No.	days after inoculation	Organs ingested	Dog No.	Oocyst discharge	Prepatent period (Days)	Maximum OPG
1	43	Striated muscles*	304	+	6	3.2×10^7
		Visceral organs†	306	+	9‡	2.4×10^7
		Brain	308	+	7	2.9×10^7
		Small intestine	309	+	6	9.4×10^6
2	53	Striated muscles	305	+	6	1.1×10^7
		Brain	307	+	6	1.0×10^7

* Diaphragm and heart
† Liver and mesenteric lymph nodes
‡ Dog did not excrete the feces between 6 and 8 days.

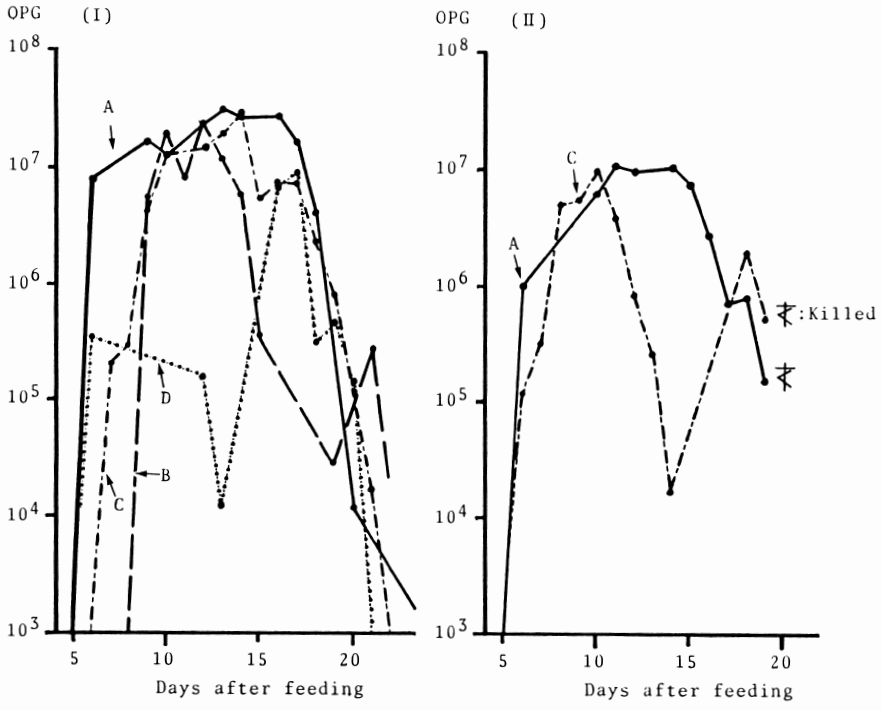

Fig. 1 OPG in dogs fed with the organs of *I. heydorni* infected cattle. OPG in dogs fed with the organs of calves killed at 43 days (I) and at 53 days (II) after oocyst inoculation.
Organ ingested. A: Diaphragm and heart. B: Liver and mesenteric lymph nodes. C: Brain. D: Small intestine.

those of *I. heydorni* including the morphological structures of oocysts, the mode of cyclic transmission, and prepatent period (Matsui *et al.*, 1981). Moreover, the distribution and morphological structures of endogenous stages of this coccidium in dogs were also similar to those of *I. heydorni* (Matsui *et al.*, 1986).

In the present experiments, when the striated muscles of cattle inoculated with oocysts of this coccidium were fed to puppies, the recipients began to shed fresh oocysts. These results suggest that this coccidium infects cattle as one of the intermediate hosts. Therefore, no difference between this coccidium and *I. heydorni* studied by Heydorn (1973) and by Dubey and Fayer (1976) was recognized. As a result, the present species and *I. heydorni* were the same species.

Regarding the distribution of *I. heydorni* in cattle, Heydorn (1973) and Dubey and Fayer (1976) reported that the dogs shed oocysts after feeding of the striated muscles of infected cattle, although no parasites were detected. The other organs except the striated muscles of infected cattle have not yet been examined.

In the present study, each dog fed the brain, small intestine, striated muscles or visceral organs of the calves shed numerous oocysts. The result suggests that the organisms surely existed in these organs. Therefore, it was considered that the organisms would parasitize the various organs when they infected cattles as same as guinea pigs reported previously.

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