SARCOCYSTIS INFECTION IN CHITAL (*AXIS AXIS*) AND DHOLE (*CUON ALPINUS*) IN TWO INDIAN PROTECTED AREAS

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Abstract

A survey of faecally dispersed parasites in Mudumalai National Park and Wildlife Sanctuary and Tadoba National Park revealed that the Dhole or Indian Wild Dog (*Cuon alpinus*) shed sporocysts of *Sarcocystis* sp. consistently in large numbers. Post mortem examination of Chital, the major prey of Dhole, showed presence of sarcocysts in the heart and skeletal muscles. Circumstantial evidence points to a Chital-Dhole life-cycle for this species. We report here the prevalence and intensities of infection of the two hosts in both the sanctuaries.

Keywords

Chital, Dhole, infection, Sarcocystis *sp., Mudumalai National Park and Wildlife Sanctuary, Tadoba National Park*

Introduction

The genus *Sarcocystis*, composed of heteroxenous cyst-forming coccidia is prevalent in a broad range of vertebrates, including mammals, birds and fishes. It has an obligatory two-host life cycle. The sexual cycle takes place in the intestinal mucosa of the definitive host, usually a carnivore, and results in the formation of sporocysts that are shed in the faeces. The asexual cycle which leads to the development of sarcocysts in skeletal or heart muscles occurs in the intermediate host that is generally a herbivore (Dubay, 1976; Soulsby, 1982).

Majority of the work on *Sarcocystis* is on the species infecting domestic animals (Dubay, 1976; Juyal, 1991; Tenter, 1995). Only few studies show evidence of the occurrence of this protozoan in wild animals including Black Bear (Dubey *et al.*, 1998), Otter (Wahlstrom, 1999), Vole (Tardos, 1976), Giraffe (Bengis *et al*., 1998), Malaysian Long-tailed Monkey (Kan *et al*., 1979), Roe Deer (Santini *et al*., 1997), White-tailed Deer (Crum & Prestwood, 1982) and Barasingha Deer (Shrivatsav *et al*., 1999). This paper provides evidence on Dhole or Indian Wild Dog (*Cuon alpinus*) being a definitive host of *Sarcocystis* sp. and Chital (*Axis axis*) an intermediate host.

Methodology

The study was carried out in two protected areas, namely Mudumalai National Park and Wildlife Sanctuary, Tamil Nadu and Tadoba National Park, Maharashtra. In both the areas, Chital, which are the most predominant ungulates among herbivores, and Dholes, which are predominant among predators and sighted very frequently were selected for the study. The two packs of Dhole in Mudumalai identified and studied by Venkataraman *et al*. (1995) were sampled repeatedly and at least three more unidentified packs in the adjoining areas were sampled during 1989-1992 and again in 1999-2000. Dholes in Tadoba were sampled during 1998-2001 - one pair and one pack of four were identified and sampled repeatedly. In addition to this, at least four other different packs were sampled during this period.

Fresh faecal samples of Dhole were collected from the study areas and were processed within four hours of collection. In case of unavoidable delays of several hours, samples were preserved in 10% formalin. The quantitative sedimentation-floatation technique (Watve, 1992; Watve & Sukumar, 1995) was used to estimate the density of sporocysts in the scats.

Skeletal and heart muscles of Chital killed by Dhole or dead due to any other causes were collected for histopathological examinations. All the samples were preserved in 10% formalin. Sections of the samples were stained with Hematoxaline and Eosine or with Iodine and the mean number of cysts cm^{-2} of section area were counted.

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Fig. 1. Sporocysts in Dhole scat (16 x 10µ)

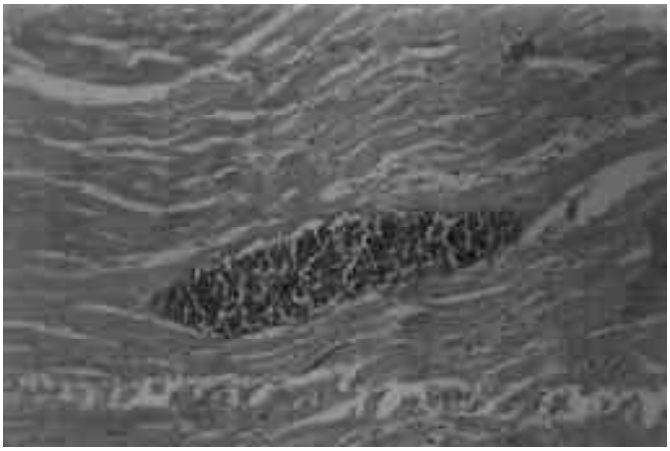

Fig. 2. Sarcocysts found in Chital heart and skeletal muscles. They do not ahow compartments and distinct cyst wall.

Results and Discussion

Sarcocystis sporocysts 16 x 10µ in size (Fig. 1) were widely and consistently detected from Dhole scats throughout the study period. A total of 239 faecal samples of Dhole from Tadoba and 209 from Mudumalai were analyzed for presence of sporocysts. Densities of 5,000-10,000 sporocysts per gram were common in these individuals and up to 26,000 per gram were occasionally recorded. The coccidian was prevalent throughout the study period in Mudumalai (median=172; prevalence=77%) and Tadoba (median=0; prevalence=77%). Whenever all or majority of individuals from a pack were sampled a large number of sporocysts were shed almost invariably by some of the individuals in a pack. Sporocysts were rarely observed in other carnivores of the study area (Watve, 1992). Out of the 69 samples of tiger from Tadoba only three showed the presence of sporocysts, and out of 36 tiger samples from Mudumalai two had sporocysts. None of the 28 samples of leopard from both the areas were positive.

The sarcocysts found in skeletal and heart muscles of Chital were small, usually less than 1mm long (Fig. 2). They did not show compartments and there was no distinct cyst wall. The cysts were found in large numbers in the heart (prevalence = 50%) and skeletal muscles (prevalence = 19.5%) in samples collected from Chital kills in Tadoba. In Mudumalai, the heart muscles showed 45.45% prevalence whereas the skeletal muscles showed 48% prevalence. Domestic dogs did not get infected after consuming infected Chital heart. Fresh Chital heart containing approximately 200 or more cysts per gram were fed to three domestic dogs. The dogs did not shed any sporocysts up to 30 days.

Neither Chital nor Dhole are available for experimental infections therefore the Chital-Dhole life cycle cannot be demonstrated directly. However, the consistent occurrence of sarcocysts in Chital and sporocysts in Dhole, the high proportion of Chital among Dhole kills (Venkatraman *et al*., 1995), absence or very low prevalence of sporocysts in other carnivores and the failure to infect domestic dogs indicate that this species of *Sarcosystis* has a Chital-Dhole cycle. It can be said with certainty that in spite of the lesser or greater degree of specificity, the major channel of *Sarcocystis* life cycle in both the study areas was Dhole-Chital-Dhole. Following the nomenclature system recommended for this genus (Levine, 1986) in which the species name consists of the herbivore genus followed by the carnivore genus, this species should be called *Sarcocystis axicuonis*.

In both the areas, there was a seasonal difference in the sporocyst densities in Dhole scats, which can be due to seasonal shift in hunting preferences of Dhole. In Mudumalai, three broad seasons are defined as follows: (i) Dry season from January to April as there is usually no rainfall during that period with only occasional showers in March. Although April usually receives a few thundershowers, the overall water availability is low. The first wet season starts in May. The Sanctuary gets pre-monsoon and south-west monsoon showers until August. The second wet season is from October to December which receives north-east monsoon showers. The 97% prevalence (median = 462) of *Sacrocystis* in Dhole was greater during the first wet season from May to August as compared to the dry season (prevalence = 80%, median = 368) and second wet season (prevalence = 81%, median = 172). The differences were statistically significant (Kruskal Wallis test KW = -96.9; $p>0.05$). The possible reason could be that during the early wet season Chitals come out on the open and aggregate in large numbers. Thus a large number of Chitals are available for Wild dogs. On the contrary, due to

thicker vegetation the prey detectability is reduced in the second wet season and Dholes might partially shift to alternative prey. In the dry season, breeding of Dholes restrict their hunting activity to a smaller area thereby limiting their access to Chital groups. This in turn, might result in decreased prevalence of *Sacrocystis* in them. Similar results were obtained in Tadoba where the wet season showed high prevalence of sarcocysts (81.8%, median = 62.8) whereas it was low during winter (prevalence = 31.9%, median = 0) and slightly increased during summer (prevalence = 57.5%, median = 0.25). The differences were statistically significant (Kruskal Wallis test, KW = 10.56, p>0.05). Although Tadoba does not receive second monsoon showers, the thick undergrowth reduces the prey visibility in early winter.

Sarcocystis sp. are generally non-pathogenic to both the hosts or are only mild pathogens. However, parasites with predator-prey life cycles are likely to influence the predator-prey dynamics and therefore warrant a careful ecological study.

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