

Prevalence of Gastrointestinal Parasites in Gaur (*Bos gaurus*) and Domestic Cattle at Interface Zones of the Nilgiri Hills, Tamil Nadu, India

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Abstract

Little is known about gastrointestinal parasite infections in wild ruminants. Faecal survey of parasitic prevalence plays an important role in wildlife management. The Wildlife interface regions, adjoining regions of forests serve as potential marker zones that serve to intermediate buffer zones that provide the viable ecology for the transit of various parasites between domestic and wild animals sharing the same landscape. Parasitic infections can cause disease and death in wild animals and can become a source of infection for domestic animals. Epidemiological studies are important to know about the status and transmission of these diseases. Parasitic diseases are best controlled by preventing the contact and parasite transmission between wild and domestic animals and by manipulating the factors involved in the disease transmission. The aim of this paper was to find out the prevalence of gastrointestinal parasites in gaur (*Bos gaurus*) and domestic cattle at interface zones of the Nilgiri hills. Qualitative examination of faecal samples from wild gaur (n=30) sharing ecosystem with domestic cattle (n=20) in the Nilgiri hills was done by Centrifugal sedimentation method and Flootation method. The prevalence was 63.3% and 80.0% in wild gaur and domestic cattle respectively with overall prevalence of 70.0%. The helminthes observed were trematodes (13.3%) include *Fasciola* sp. (3.3%), *Amphistome* sp. (6.7%) and *Schistosoma* sp. (3.3%), cestodes (20.0%) include *Moniezia* sp. nematodes (43.3%) include *Toxocara* sp. (6.7%), Strongyle sp. (23.3%), *Oesophagostomum* sp. (3.3%), *Trichuris* sp. (6.7%) and *Mecistocirrus* sp. (3.3%) and unsporulated *Coccidia* oocysts (13.3%) in wild gaur. It was concluded that, parasitic prevalence survey is vital in monitoring the impact on the health and maintenance of wild gaur population, and the prevalence of GI parasites recorded in the wild gaur and domestic cattle in the study areas shows the need to design and implement a control policy of helminth parasites in the Nilgiri hills.

Keywords: Gaur; Domestic cattle; Gastrointestinal parasite; Interface

Introduction

Little is known about gastrointestinal (GI) parasite infections in wild ruminants. The information available regarding biodiversity of GI nematodes in wild gaur population from the Nilgiri hills including of Mudumalai Wildlife sanctuary is lacking, and also meager in wild animals due to paucity of systematic investigation [1]. Parasitic loads in wild herbivores including chital (*Axis axis*), gaur (*Bos gaurus*), elephants (*Elephas maximus*) and domestic cattle in the Mudumalai Wildlife Sanctuary; southern India was documented [2-5]. Systematic investigation of parasitic diseases of wildlife is still in its infancy in India and data are still on the base line. The wild Gaur is listed as vulnerable on the IUCN Red List since 1986.

The advance of agriculture and cattle-raising into natural areas, humans and their domestic animals have recently been coming into greater contact with populations of wild animals in their habitats. This closer contact facilitates the spread of infectious agents and parasites to new hosts and environments, thereby establishing new relationships between hosts and parasites, and new ecological niches in the disease transmission chain [6]. Parasitic burden may negatively influence the health status of the animals [7]. A number of factors threaten the existence of wild animals in India, including infectious parasitic diseases arising from gastrointestinal parasites [8,9]. Parasitic diseases constitute one of the major problems causing even mortality in wild

animals, the effects of which range from sub-clinical to death. Parasites cause a multitude of problems for wildlife and although it often appears that wildlife have adapted to the presence of parasites, they have not adapted to the adverse effects of parasitism [10]. Parasites can affect host survival and reproduction directly through pathological effects (blood loss, tissue damage, spontaneous abortion, congenital malformations and death) and indirectly by reducing the host's immunity and affecting the physical condition [9].

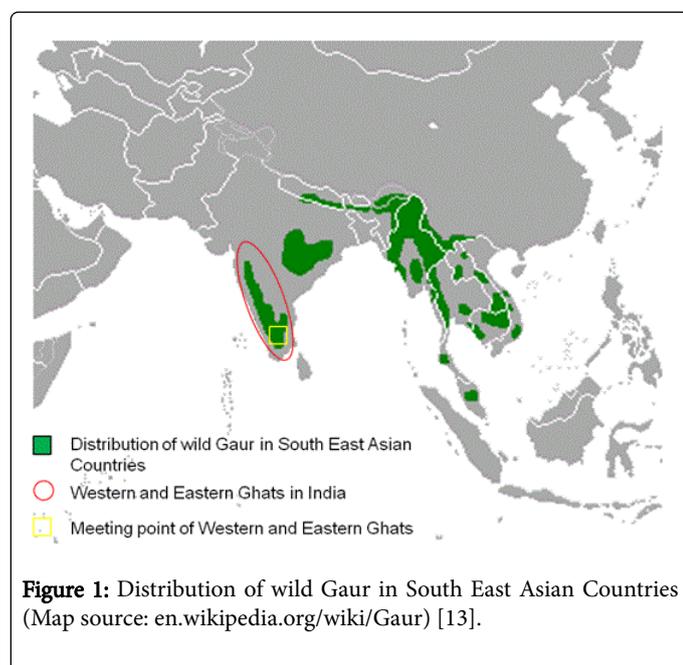
Parasitic infections can cause disease and death in wild animals and can become a source of infection for domestic animals. Epidemiological studies are important to know about the status and transmission of diseases. Parasitic diseases are best controlled by preventing the contact and parasite transmission between wild and domestic animals and by manipulating the factors involved in the disease transmission [11]. In the present study, we report the diversity and prevalence of gastrointestinal helminth fauna of wild Gaur (*Bos gaurus*) in an area that for decades has had other ruminants both wild and domestic herbivorous in the Nilgiris, Tamil Nadu, India and discuss the possible implications of wild Gaur ecology.

Materials and Methods

Study area, population and habitat

The Nilgiri hills, which is located at a point where the Western Ghats meet the Eastern Ghats (Figure 1). The climate of the area is

temperate with ever-green forests. In these hills, the Mudumalai Wildlife Sanctuary is located, which has a mix of flat land, undulating parkland, open grassland, swamp, valleys and nallahs. The sanctuary has an area of 321 Sq. KM with 108 sq.KM of National Park area. It lies within 11°30' N to 11°42' N and 76°30' E to 76°45' E. Rainfall ranges from 800-2000 mm. Temperature varies from 14°C to 33°C. Altitude ranges from 100' MSL to 1200' MSL. The terrain is extremely varied with hills, valleys, ravines, watercourses and swamps. The vegetation comprises of tropical moist deciduous forests, dry deciduous forests and scrub forests. The fauna include Elephants, Gaur, Banner, Macaque, Common Langur, Tigers, Leopards, Chital, Panther, Sloth Bear, Python, Barking Deer, Four Horned Antelope, Otter, Crocodiles (Mugger), Giant Flying Squirrel, Sambar, Hyena, Wild Dog, Wild Boar, Mouse Deer, Spotted Deer, Jackal, Hare, Porcupine and Mongoose (Tamil Nadu Forest Department, www. http://www.forests.tn.nic.in/wildbiodiversity/ws_mws.html) [12].



Collection of faecal samples

Samples were collected from wild gaur and domestic cattle irrespective of age groups of both the sexes, which shared common ecosystem in the Nilgiri hills for their food and habitat. The herd was tracked on foot and freshly voided faecal samples about 20-30 g was collected in interlocked polythene bags (30 from wild gaur and 20 from domestic cattle). The samples were properly sealed, labeled with date, time, and location and transported to the laboratory with ice-cold condition to avoid hatching of eggs and immediately transferred to containers containing 10% formalin as the preservative.

Qualitative examination faecal samples

Centrifugal sedimentation and/or floatation technique to determine trematode eggs, cestode eggs, nematode eggs and coccidian oocysts were followed for qualitative analysis of faeces with few modifications [9,14].

Centrifugal sedimentation method

Screening for eggs of trematodes and cestodes followed. A small quantity of faeces (3 gm) was mixed well with water (15 ml) and then filtered using a strainer to remove coarse faecal material. The filtrate was poured into a centrifuge tube and centrifuged at 2000 rpm for 5 minutes. The supernatant was discarded and a drop of the sediment was taken on a clean, dry glass slide, placed a cover glass and examined under low power (10X) of the microscope.

Floation method

Screening for eggs of nematodes followed. A small quantity of faeces (3 gm) was mixed well with water (15 ml) and then filtered using a strainer to remove coarse faecal material. The filtrate was poured into a centrifuge tube and centrifuged at 2000 rpm for 5 minutes. The supernatant was discarded. The sediment was then mixed with saturated sugar solution in a centrifuge tube till upper meniscus was formed and waited for 10 minutes. A clean cover glass was touched over upper meniscus of the floatation fluid and then placed on a clean, dry glass slide, and examined under low power (10X) of the microscope.

Collection of meteorological parameters

The details of the meteorological parameters of the Nilgiris were obtained from the Tamil Nadu Agricultural University (TNAU) portal.

Management

Within the adjoining regions of wildlife areas taken under study suitable management measures were framed and recommended.

Result and Discussion

Non-invasive studies of wildlife parasites can readily provide data on presence or absence of parasitic prevalence [15]. Interference to ecosystem such as deforestation, construction of roads, buildings, check dams, agriculture, formation of ecological mosaics, tourism, etc., changed the diurnal habits of wild gaur in to nocturnal. They herd together during dry summer season and then dispersing into the hills with the arrival of the monsoon. They frequently go into fields and graze alongside domestic cattle. Eggs of trematodes, cestodes, nematodes and protozoal oocysts were identified in this survey both in wild gaur and domestic cattle under the common ecosystem (Tables 1 and 2). Endoparasite fauna in wild animals and consequent detection of infection in these animals might suggest that there could be proximity to and interactions with domestic animals and/or humans [16]. The prevalence of GI parasites in wild animals might be due to absolute lack of health care, diversified feeding behavior, dispersing of wild animals from core zone of wildlife environment in to the buffer zones or ecological interfaces, where co-existing of gaur, Nilgiri tahr, sambar deer, spotted deer, wild pigs with domestic cattle, sheep and goats [17].

Animals screened	Number faecal positive	% positive
Wild gaur (n=30)	19	63.3
Domestic cattle (n=20)	16	80.0

Table 1: Prevalence of parasitic eggs in wild gaur and domestic cattle in the Nilgiri hills.

Helminthic parasite category	Wild gaur		Domestic cattle		Overall	
	No. positive	% positive	No. positive	% positive	No. positive	% positive
Trematodes	4	13.3	1	5.0	5	10.0
Cestodes	6	20.0	6	30.0	12	24.0
GI nematodes	13	43.3	15	75.0	28	56.0
Coccidia oocyst	4	13.3	6	30.0	10	20.0

Table 2: Overall parasite prevalence in wild gaur and domestic cattle in the Nilgiri hills.

The parasitic prevalence was 63.3% and 80.0% in wild gaur and domestic cattle respectively with overall prevalence of 70.0%. The helminthic parasites observed were trematodes (13.3%) include *Fasciola* sp. (3.3%), Amphistome sp. (6.7%) and *Schistosoma* sp. (3.3%), cestodes (20.0%) include *Moniezia* sp. (20.0%), nematodes (43.3%) include *Toxocara* sp. (6.7%), Strongyle sp. (23.3%), *Oesophagostomum* sp. (3.3%), *Trichuris* sp. (6.7%) and *Mecistocirrus* sp. (3.3%) and unsporulated *Coccidia* oocysts (13.3%) in wild gaur (Table 3 and Figure 2). Chakraborty and Islam performed study in wild herbivores at Kaziranga National Park and recovered the eggs of strongyles, *Strongyloides* sp. *Ascaris*, *Paramphistomum*, *Fasciola* and

oocyst of coccidian [18]. Gaur et al. recorded maximum prevalence of strongyles (20.25%), followed by *Fasciola* sp. (16.46%), *Strongyloides* sp. (15.19%) and amphistomes (12.66%) at Corbett National Park [19]. Mandal et al. also reported maximum infection of strongyles (41.67%), followed by amphistomes (15.63%), *Fasciola* sp. (13.54%), *Strongyloides* sp. (11.46%) and *Ascaris* sp. (5.29%) in wild herbivores at Mudumalai Wildlife Sanctuary [20]. Dharmarajan et al. reported helminthic loads in wild gaur and domestic animals also in the Mudumalai Wildlife Sanctuary, southern India [3-5].

Eggs of parasite identified	Wild gaur		Domestic cattle		Overall	
	No. positive	% positive	No. positive	% positive	No. positive	% positive
<i>Fasciola</i> sp.	1	3.3	1	5.0	2	4.0
Amphistome sp.	2	6.7	0	0	2	4.0
<i>Schistosoma</i> sp.	1	3.3	0	0	1	2.0
<i>Moniezia</i> sp.	6	20.0	6	30.0	12	24.0
<i>Toxocara</i> sp.	2	6.7	3	15.0	5	10.0
Strongyle-type egg	7	23.3	11	55.0	18	36.0
<i>Oesophagostomum</i> sp.	1	3.3	0	0	1	2.0
<i>Mecistocirrus</i> sp.	1	3.3	0	0	1	2.0
<i>Trichuris</i> sp.	2	6.7	1	5.0	3	6.0
Cocidia oocyst	4	13.3	6	30.0	10	20.0

Table 3: Prevalence of parasitic eggs wild gaur and domestic cattle in the Nilgiri hills.

Considerable amount of parasitic prevalence was noticed both animal species. However, certain parasite eggs were not been found in domestic cattle, which were observed in wild gaur, perhaps due to lesser number of samples screened. The prevalence of strongyle-type eggs (23.3%), eggs of tapeworms (20.0%) and unsporulated coccidial oocysts (13.3%) were higher in wild gaur, which has directly correlated

with findings in domestic cattle in this faecal screening survey. Bhatt found significantly higher parasitic loads in wild herbivores including gaur during the southwest monsoon than dry season [2]. Increased pasture contamination and parasitic burden during rainy season had increased survival of larvae and increased intermediate hosts [20].

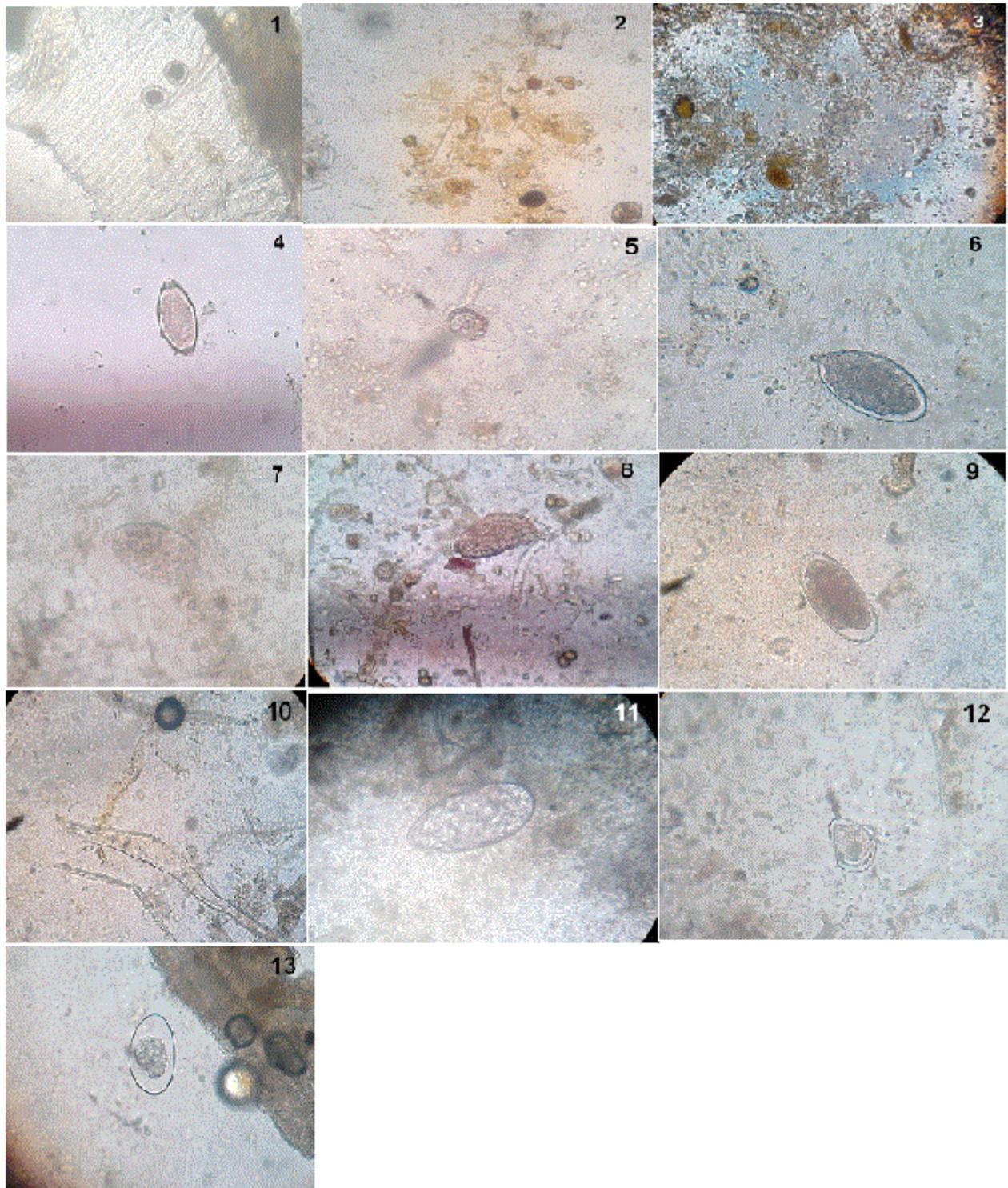


Figure 2: Eggs of parasites identified in wild gaur and domestic cattle in the Nilgiri hills. (1) *Toxocara* sp, (2) *Eimeria* sp. (Coocidia oocyst-unsporulated), (3). *Mecistocirrus* sp, (4). *Trichuris* sp, (5). Strongyle-type egg, (6). *Oesophagostomum* sp, (7). *Amphistome* sp, (8). *Schistosoma* sp, (9). Strongyle-type egg, (10). *Schistosoma* sp, (11). *Fasciola* sp, (12). *Moniezia* sp, (13). Strongyle-type egg.

The temperature and humidity of the area, which are suitable for the development of endoparasites. Domestic animals were found to harbor more internal parasites as compared to wildlife. In the traditional management of domestic animals in the study areas, cattle graze

together, besides sheep and goats, which might explain the higher prevalence of helminthes among domestic animals and wildlife. This parasitological study showed that both domestic and wildlife animals also share the same parasite species with different levels of infestation. Rossanigo and Gruner who reported that nematodes are responsible for most of the helminthes diseases of veterinary importance [21]. The high prevalence encountered may be explained by the existence of favourable climatic conditions which support prolonged survival of infective nematode larvae on pasture [22]. Moderate temperature and more humidity between the soil and the herbage favorable to the survival of eggs and free-living stages of parasites. The higher rate of prevalence during the rainy season is due to the existence of a suitable microclimate for the survival and propagation of free-living larval stages of parasites at several places. The parasitic ova, snails and other intermediate host get a favorable humid sub-tropic climate for development in the plane grazing areas with shallow temporary stagnated water. The animals congregate at the greens available around the periphery of such areas and naturally acquire more infection [8]. However, low grade infections should not be neglected. Most of the animals examined did not show any obvious clinical signs, suggesting low to moderate infection at sub clinical level. This means that an undetermined number of wild animals may be parasitized without even showing outward or overt physiological signs of infection [10].

Epidemiological investigation on deworming of domestic cattle revealed that, regular deworming was not practiced, unless mass vaccination and deworming camps are conducted. Domestic cattle were run on community grazing land and open pasture land nearby evergreen forests in the Nilgiri hills by the farming community and tribes. People engaged with agricultural activities graze their animals during day time and the animals are housed during night hours. Wild gaur shares habitats along with domestic animals including cattle. Hence, the transmission dynamics of parasitic diseases could be from either side of the animal species. If hypothesis is, contamination of pasture land with parasitic eggs by the domestic cattle and subsequent transmission to wild gaur, regular deworming in domestic animals could definitely reduce the parasitic prevalence in wild animals. Moreover, the spill-over nature of any infectious pathogens from wild animals can also be reduced. Whenever there is clinical infection of parasites, could be treated, but in wild animals may result in death of the heavily infested cases. The distribution of cestode infection in livestock is influenced by the occurrence of invertebrate hosts that harbor the infective metacystodal stage and trematodes by the presence of snails [23]. The Nilgiri hills are more prone to rainfall and the runoff water often stays at the valleys forming small nallays and ponds which are effective for survival of snails. The domestic cattle and gaur share the water sources and thus a disease transmission dynamics sets in paving way to disease occurrence. The nematodes parasites have direct life cycle and do not involve any intermediate host and are transmitted by faecal contamination of feed, water and soil. The survivability of the helminth parasites is highly influenced by climatic factors. Other parasites, mainly trematodes and some cestodes require an intermediate host for their transmission. The wild animals and the domestic animal share the same water source and pertaining to the humidity and rainfall in the study area numerous intermediate hosts are bound to exist, Parasitism, especially endoparasitic infection produces ill effects such as weakness, emaciation, inappetance and predisposes the animals to various potential pathogens. It has been reported that regular faecal examination for parasitic ova/larva along with assessment of parasitic load and administration of desired anthelmintics, when warranted, at regular intervals [9]. Parasites in

such a large amount can certainly have considerable impact on the health, behaviour and reproductive success of individuals [24]. The chances of acquiring parasitic infection around waterholes can be controlled by suitable physical, chemical and biological methods. Rotational cropping of pastures can reduce the influence of mat formation and therefore parasitic survival. Use of regular pasture and habitat improvement along with rotational grazing practices may be followed to improve host nutrition and help maintain their resistance to parasitism in a natural manner [8]. Veterinary monitoring is an integral part of wildlife management and forms an empirical basis for eco-system health in protected areas [25,26].

Conclusion

It is concluded that, parasitic prevalence survey is vital in monitoring the impact on the health and maintenance of wild gaur population, and the prevalence of GI parasites recorded in the wild gaur and domestic cattle in the study areas shows the need to design and implement a control policy of helminth parasites in the Nilgiri hills. The occurrences of a much lower level of parasitism in gaurs than in domestic cattle correspond to the higher levels of inclusion of tannin in the natural diet of gaurs. Tannin content from trees, tea leaves in their habitat serve as natural anthelmintic, constantly keeping the parasitic load under check. On the other hand domestic cattle must be regularly dewormed and the control of intermediate hosts must be intuited. However further research with individual animals will lead to concrete results.

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