Full Length

OCCURRENCE OF *TAENIA HYDATIGENA* IN WILD CARNIVORES ACROSS DIFFERENT FOREST RANGES IN THE NILGIRIS, TAMIL NADU, INDIA

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ABSTRACT

The paper presents the findings on occurrence of cestode infection in wild carnivores during postmortem examination across different forest ranges in the Nilgiris district of Tamil Nadu, India over a period of sixteen months. A total of 37 wild carnivores comprising of seven dholes, four leopard cats, ten tigers and 16 leopards were examined from December 2023 to March 2025. Postmortem examination was conducted by the forest veterinary officer following standard procedures. The tapeworms were collected, labelled, processed as per standard procedures, identified and photographed. Out of the 37wild carnivores, 11 were found infected with cestodes (29.72%) which were identified as Taenia hydatigena morphologically. This comprised of one leopard cat (25%), two dholes (28.57%), five tigers(50%) and three leopards (18.75%). Out of the 11 infected animals, six were males (54.54%) and five were females (45.45%). Also, among the infected animals, one was below one year of age (9.09%) and 10 were above one year of age (90.90%).

Key words: Occurrence,cestodes,*Taenia hydatigena*, wild carnivores, The Nilgiris

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INTRODUCTION

Wild carnivores such as tigers, lions, leopards, wolves, dholes etc. are among the valuable fauna in the forests of India. They are crucial to healthy ecosystems, acting as apex predators regulating prey populations, maintain biodiversity, and contribute to the overall stability of their habitats (Sahu *et al*., 2012). Healthy population of wild carnivores signal a healthy ecosystem, indicating sufficient prey, biodiversity, and overall ecological integrity. Several factors such as diseases, habitat fragmentation, poaching, territorial fights etc. threaten these animals and therefore it is crucial to preserve the population of these carnivores (Varun, 2005). Parasitic helminths play a major role in affecting the health status of

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wild carnivores. It is important to study the parasitic dynamics in wild populations, especially predatory animals, as parasites can transfer to domestic animals and even humans (Shirbhate, 2008; Marathe *et al.,* 2002). Several endoparasites (flukes, tapeworms, nematodes), ectoparasites (arthropods and acarines) and protozoa affect wild carnivores. Among helminths, tapeworms cause significant morbidity and mortalitydue to severe enteritis apart from intestinal obstruction in heavy infections. Notable tapeworms infecting wild carnivores include *Echinococcus granulosus, Taenia taeniaeformis, Mesocestoides corti, M. litteratus, Taenia serialis, Taenia hydatigena, Diphyllobothrium latum and Spirometra. T. hydatigena* is cosmopolitan in distribution and occurs in small intestine of dogs, wolves and other wild carnivores and the metacestodes of *T. hydatigena* (*Cysticercus tenuicollis*) are found in the liver of the prey species such as deer (Rao *et al.*, 2003), wild ruminants (Soulsby, 2005), chital, wild pig and Rhesus macaque (Bhattacharya, 2001) and langur (Kolangath *et al.*, 2024). Infection is acquired by consumption of meat of infected prey animals containing the cysts. The understanding of these parasites found in wild carnivoresis essential for studying their ecology and to establish correct programs of prophylaxis (Gonza´ lez *et al.*, 2007).

The Nilgiris Biosphere Reserve is situated in the Nilgiris Mountains of the Western Ghats in the state of Tamil Nadu, South India and is home to several mammals including a very good population of wild carnivores such as tigers, leopards, leopard cats and dholes. Important prey species of these wild carnivores such as deer, wild pig, macaque etc. are also available in plenty. Since this area is rich in animal population, significant mortalities occur throughout the region. Hence, in this study the occurrence of cestode infection in wild carnivores were recorded through postmortem examination in different forest ranges of the Nilgiris district, Tamil Nadu, India.

MATERIALS AND METHODS

The study was conducted in The Nilgiris which lies at the juncture of the Western Ghats and the Eastern Ghats. Its latitudinal and longitudinal coordinates are 11°12 N to 11°37 N and 76°30 E to 76°55 E, respectively (Fig. 1). Due to its high altitude, the Nilgiris has a significantly cooler climate than the surrounding plains. The region receives substantial rainfall throughout the year, with monsoon seasons impacting the weather. It experiences summer, monsoon and winter seasons. The summer starts from March and extends up to June, followed by the monsoon season from July to September and the winter season is from October to February. During summer, the temperature reaches a maximum of 25°C (77°F) and a minimum of 10°C (50°F). During winter the maximum temperature is 20°C (68°F) and the minimum goes below 0°C (32°F). The average annual rainfall of The Nilgiris is 1,920.80 mm. The study area included thirteen different forest ranges. The ecosystem of the study areas included tropical evergreen forests, Montane sholas and grasslands, semi-evergreen forests, moist deciduous forests, dry deciduous forests and thorn forests.

Detailed post mortem examination of 36 wild carnivores comprising of six dholes, four leopard cats, ten tigers and 16 leopards was carried outduring the period from December 2023 to March 2025 by the forest veterinary officer following standard procedures. The animals screened were from different forest ranges of the Nilgiris, viz., Singara, Ovalley, Cherambadi, Kundha, Udagai North, Segur, Masinagudi, Gudalur, Bitherkadu, Pandalur, Kothagiri, Nilakottai and Theppakadu.

During postmortem examination, the entire digestive system was carefully screened for pathological lesions and presence of tapeworms. The worms recovered were stored in separate sterile plastic containers with 10% formalin, labelled and despatched to the Department of Veterinary Parasitology, Veterinary College and Research Institute, Theni for processing and species identification.The label included details such as the date of post mortem and sample collection, forest range where the post mortem was conducted,information about the animal (species, age, and sex), details of worms collected, location of worms and the sample identification number.

Once the samples were received, the details were recorded. The tapeworms from different wild carnivores were counted separately and recorded. A total count of worms was made. Length and width of the worms were recorded. Worms were then examined for gross morphological features and then processed by standard procedures. Different parts of cleared specimens such as scolex and segments (immature, mature and gravid) of tapeworms were mounted in DPX and examined under stereoscope and light microscope and morphological features were recorded. Photographs of gross tapeworms were taken using NIKON Digital camera-mirrorless-Z5 model with NIKKOR Z-24-70 MM F/4S lens. Photographs of mounted specimens in microscopic slides were taken using Trinocular microscope (Lawrence and Mayo-Lynx, CAT. No: LM-52-3000, Sl. No: 500700) under 4x magnification with photomicrograph and computer attachment.

RESULTS AND DISCUSSION

Tapeworms recovered from the wild carnivores were identified as *Taenia hydatigena* morphologically and were white or cream coloured (Fig. 2). The tapeworms were 49 - 79 cm long (Average 60 cm) with a width of 0.5 cm. The scolex had two rows of rostellar hooks and four suckers (Fig.3). Immature segments did not reveal any appreciable structures (Fig. 4) whereas mature segments had male and female reproductive organs (Fig. 5). Gravid proglottids had uterus with 8 to 10 lateral branches (Fig. 6). Eggs were round with a thick, radially striated shell and a hexacanth larva within the eggs (Fig. 7). Species identification of *Taenia hydatigena* was confirmed through morphological features and gross structures. The presence of oncosphere in the egg, uterine branches in the gravid segments and rostellar pattern in the scolex are species specific. Since the features are very specific to the species, further confirmation through molecular techniques was not warranted (Sgroi *et al.*, 2020).

Out of the 37 wild carnivores, 11 were found infected with *T. hydatigena* (29.72%) which included one leopard cat (25%), two dholes (28.57%), five tigers (50%) and three leopards (18.75%). The details of affected host, parasite species, age, location of tapeworm and forest area under study are all listed in Table 1.

A total of 79 tapeworms were recovered from the wild carnivores out of which four were from dholes, four from leopard cat, 26 from leopards and 45 from tigers. The number of tapeworms ranged from 2-16. The heavily infected animal was a three-year-old male tiger which harboured 16 tapeworms in the intestine which was closely followed by nine-year-old male leopard which harboured 15 tapeworms in the intestine. The least infection was seen in the seven-year-old male and female dhole with only two tapeworms in the intestine. The average number of tapeworms overall was seven per infected animal (Fig. 8. 9).

Taenia hydatigena is widely spread in the carnivores such as tigers, leopards, wolves, dholes etc. which form the definitive hosts for the parasite. Intermediate hosts for this tapeworm include wild boars, deer, wild ruminants and domestic livestock (Chapman and Chapman, 1987; Nguyen *et al*., 2016; Filip *et al.*, 2019). Herbivores and domestic animals ingest the eggs from contaminated pasture, eggs develop into larval or bladderworm stages (*Cysticercus tenuicollis*), which are consumed by definitive hosts, the worm reaches maturity in its definitive host where it attaches to the intestine by means of the rostellar hooksand grow to adult. In the past *Taenia hydatigena cysticerci* has been documented in a wide variety of species including the wolves, red foxes, corsac foxes, and snow leopards from Mongolia (Ulziiargal *et al*., 2020); European wolves from Poland (Filip *et al*., 2019). Wild boar has been found to be an important species in dissemination of the infection to carnivores in sylvatic life cycle in Italy (Sgroi *et al.*, 2020). India has also reported the infection in species like sheep (Singh *et al*., 2015), pig (Deka *et al.*, 1985) and goat (Moudgil *et al*., 2022).

Out of the 11 infected animals, six were males (54.54%) and five were females (45.45%). Also, among the infected animals, one was below one year of age (9.09%) and 10 were above one year of age (90.90%). The infected dholes were seven years old; one was male and the other female. The leopard cat was an eight months old female. Among the three infected leopards, one was a 12 years old female, second was a nine years old male and the third was a six years old male. Among the five infected tigers, three were males (1.5, 3 and 10 years) and two were females (10 and 5 years). The incidence in leopards was 66.66% in males and 33.33% in females whereas in tigers, it was 60% in males and 40% in females.

In the present study, the animals positive for tapeworm infection were observed from six forest ranges viz., Udagai North, Gudalur, Masinagudi, Bitherkadu, Nilakottai and Singara. Out of the 11 animals found positive for tapeworms, three were from Bitherkadu (27.27%), two were from Nilakottai (18.18%),two were from Singara (18.18%), two were from Gudalur (18.18%), one was from Udagai North

(9.09%) and one was from Masinagudi (9.09%) forest ranges. The only infected leopard cat, the eight months old female was from UdagaiNorth Forest range and both the dholes, the seven years old male and seven years old female were from Singara forest range. Among leopards, the 12-years old female was from Gudalur forest range, the nine years old male was from Masingudi forest range and the six years old male was from Bitherkadu forest range. Among tigers, both the one and half years old male and 10 years old female were from Bitherkadu forest range, five years old female and 10 years old male were from Nilakottai forest range whereas the three years old male was from Gudalur forest range.

In a study by Thakhova *et al.* (2016), it was observed that the incidence of cestodes and the intensity of worms were high in young domestic and stray animals. Another study by Sgroi *et al.* (2020) stated that intensity of worms increases in adult wild animals due to accumulation of parasites during the animal's life span. However, in our study there was no such relation between the number of parasites and the age of the animals. Similarly, significant difference between various ranges were also absent as different animals in different ranges exhibited various worm intensities.

In tapeworm infected wild carnivores, enteritis with dark red contents in the lumen was appreciated and in some cases with more than fifteen numbers of tapeworms, blockage of intestine by bunches of tapeworms was observed. Carcasses of tapeworm infected leopards and tigers showed emaciation with rough hair coat and thin body muscle mass. The most common cestode infection encounteredin wild felids is echinococcosis and taeniasis (Moudgil *et al.*, 2015), the adult stages are usually recovered from captive andrescued free-ranging wild felids, but in this study only adult *Taenia hydatigena* tapeworms were present. The adult stages causecatarrhal enteritis in wild animals and the parasite deserves particular attention due to its significant zoonotic potential (Acharjyo, 2004). These tapeworms especially in large numbers could be one of the reasons for the death of the infected wild carnivores.

The present data records the incidence of *T. hydatigena* infections among wild carnivores across different forest ranges of the Nilgiris, Tamil Nadu. The influence of climatic factors, contamination of soil with tapeworm eggs, multiple transmission modes, involvement of potential prey species carrying the bladder worm stages etc. needs to be explored. These data gathered in the present study will help zoologists, veterinarians, parasitologists and allied professionals for understanding tapeworm infections in wild carnivoresand to design suitable control strategies which will be highly essential for the development of disease control campaigns in wild carnivores in future.

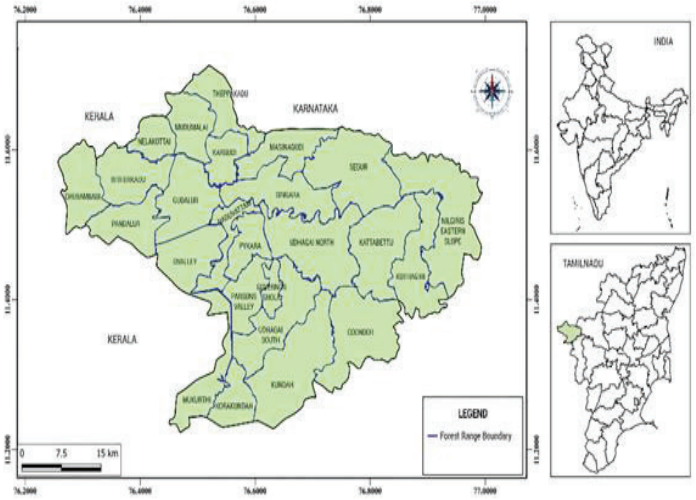

Fig. 1. Location map of the study area

Fig.2. Tapeworms collected from the intestine of a tiger

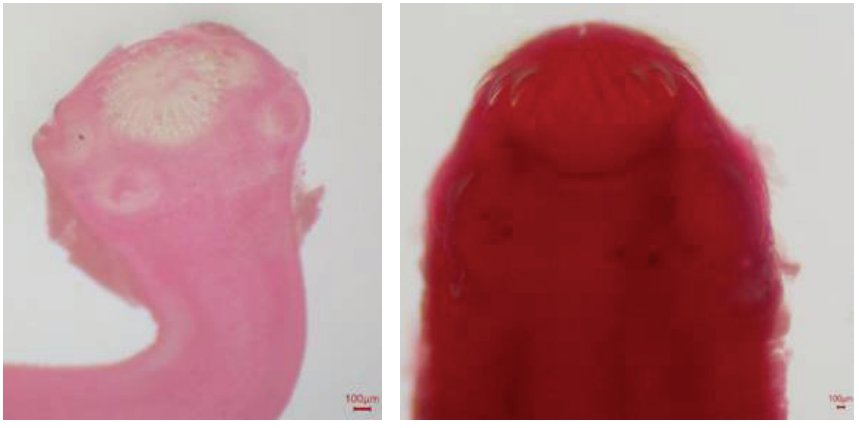

Fig. 3. Scolex of *Taenia hydatigena* showing rostellar hooks and suckers

Fig. 4. Immature segment of *Taenia hydatigena*

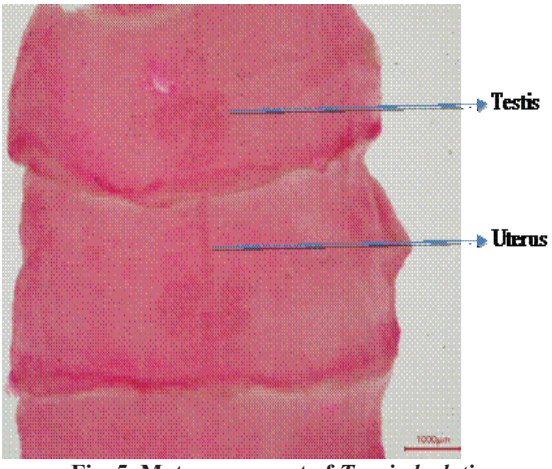

Fig. 5. Mature segment of *Taenia hydatigena*

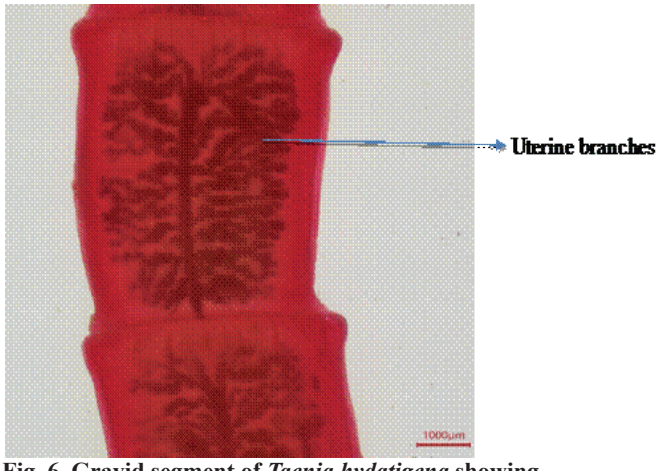

Fig. 6. Gravid segment of *Taenia hydatigena* showing uterine branches

Fig. 7. Egg of *Taenia hydatigena*(10X)

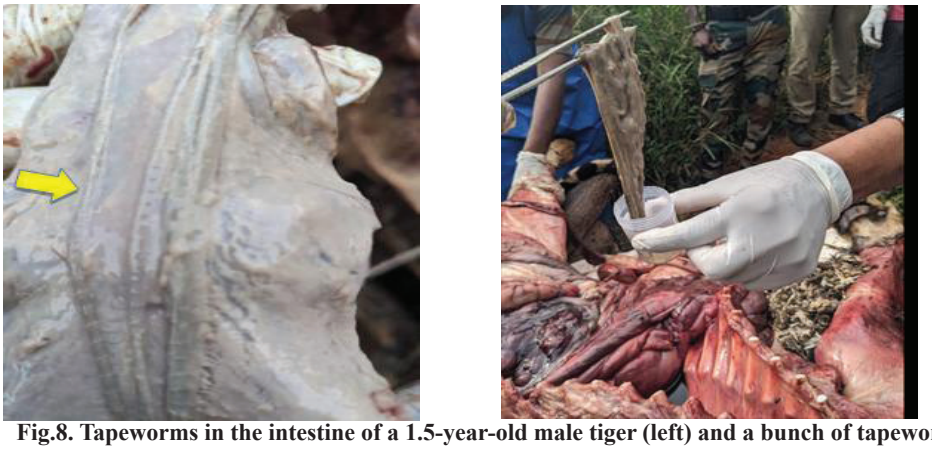

Fig.8. Tapeworms in the intestine of a 1.5-year-old male tiger (left) and a bunch of tapeworms from the intestine of a 3 years old male tiger (right)

Fig. 9. Tapeworms from the intestine of a 10-year-old female tiger (left) and in situ location of tapeworm in the intestine of the same animal (right)

Table.1. Details of *Taenia hydatigena* infection in wild carnivores from different forest ranges of The Nilgiris

S.No.	Wild carnivore	Forest Range	Details of animal (Age and Sex)	Location of tapeworms	Species	Total no of tapeworms
1.	Dhole	Singara	7 years male	Intestine	Taenia hydatigena	2
2.	Dhole	Singara	7 years female	Intestine	Taenia hydatigena	2
					Total (in Dhole)	**4**
3.	Leopard cat	Udagai North	8 monthsfemale	Intestine	Taenia hydatigena	4
					Total (in Leopard cat)	**4**
4.	Leopard	Gudalur	12 years female	Duodenum	Taenia hydatigena	3
5.	Leopard	Masinagudi	9 years male	Intestine	Taenia hydatigena	15
6.	Leopard	Bitherkadu	6 years male	Intestine	Taenia hydatigena	8
					Total (in Leopard)	**26**
7.	Tiger	Bitherkadu	1.5 years male	Intestine	Taenia hydatigena	8
8.	Tiger	Bitherkadu	10 years female	Intestine	Taenia hydatigena	10
9.	Tiger	Gudalur	3 years male	Intestine	Taenia hydatigena	16
10.	Tiger	Nilakottai	5 years female	Intestine	Taenia hydatigena	6
11.	Tiger	Nilakottai	10 years male	Intestine	Taenia hydatigena	5
					Total (in Tiger)	**45**
					Grand Total	**79**

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