

Parasitary infestation in three tiger cubs

Case Report

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ABSTRACT

Being an apex predator, the tiger is known as an indicator of healthy ecosystems. This animal's crucial role causes a significant decrease in the population, in case death occurs the ecosystem devastation also occurs. This highlights the importance of this species' protection. Apart from hunting, traps, road casualties, starvation and unidentified reasons, diseases, mostly parasites are one of the most significant reason of these animals' death. There are different researches explaining the most important and frequent parasites detected in tigers. *Toxocara* spp. is one of them. This case report explains the treatment period of three tiger cubs suffering from *Toxocara* spp. One female cub and a male cub revealed gastrointestinal signs. Anemia accompanied these signs in male cub. The third cub was asymptomatic. Apart from supportive treatment, pyrantel pamoate was administrated to all cubs. The treatment was judged as successful. The therapy procedure and preventive measurements were evaluated.

Keywords: Tiger, *Toxocara* spp. parasitary infestation, felid, wildlife

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Introduction

Most of the feline species are between endangered ones because of their decreasing habitats due to anthropogenic effects. As a result, loss of several individuals may worsen the species' extinction (Natalia et al., 2017). It is documented that only 3500 wild tigers survive in very small isolated populations which are prone to extinction (Walston et al., 2010). The dramatic diminution in tiger population highlights that there is an urgent necessity to recognize, prevent and treat big cats' diseases.

A better knowledge about parasitary infestations will help to protect these rare and precious animals (Natalia et al., 2017). Captive carnivores suffer a wide array of parasitic infestations; which reflects the diversity of seven different carnivore families. Yet, there is only few parasitic infestations known to cause diseases in carnivores and these may be prevented

and cured with appropriate husbandry, precautions and therapy (Williams and Thorne, 1996). In contrary, felids live in large areas in their natural habitat; which makes them to face lesser parasitic agents and consequently having low resistance against parasitary infections. In addition to this, captive lifestyle facilitates the susceptibility to infectious diseases (Raja et al., 2014).

Krone et al. (2008), explicate that reports about parasitary infestation spectrum on wild cats are seldom and generally based on very small groups. Their research exhibited that 8 endoparasite species infested wild cats; those species being listed as *Toxocara mystax*, *Toxascaris leonina*, *Petrowospirura petrowi*, *Capillaria aerophila*, *Capillaria plica*, *Capillaria feliscati*, *Taenia taeniaeformis*, *Mesocestoides litteratus* (Krone et al., 2008).

In general, data concerning parasites in tigers are obtained from various researches realized in zoos.

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Literature explains 25 helminth species in tigers. Protozoan parasites causing infection in tigers are listed in various reports, the pathogens being identified such as *Trypanosoma evansi*, *Babesia* species, *Isospora felis*. Tigers are frequently infected with *Trypanosoma evansi* and symptoms include anorexia, pyrexia, panting, occasional convulsions and sudden death (Moudgil et al., 2015).

Reports explicate that the most commonly encountered trematode infection in free-living and captive wild felids is paragonimiasis. Royal Bengal Tigers were reported to be infected with *Paragonimus westermani* (Moudgil et al., 2015). Sano et al. (1994) recovered *Paragonimus* eggs from four tigers and they explicated these eggs differed from the eggs of *Paragonimus westermani*; which raised a debate about whether a new species of *Paragonimus* was identified (Sano et al., 1994).

Reports explain that domestic and wild species interaction plays an important role in spreading of infectious disease (Furtado and Filoni, 2008). On the other hand, the parasitary infestation rate (93 %) found for wild cats was higher than the same percentage existed for domestic cats. The difference was related to the anthelmintic prophylaxis provided by the owners of domestic cats. In addition, feeding exclusively on wild prey augments the probability of being infested by parasites. Thus the higher parasite burden and diversity in wild cats are possibly related to wider potential intermediate host diversity in wild cats' diet than in domestic cats (Krone et al., 2008).

Natalia et al.'s research shows that parasite (helminth) diversity in close-related species may differ according to habitat use and climatic properties. In addition to climate characteristics, snow may cover and protect parasite eggs from the cold. Another important factor is that spatial and social organization of the felid species; those who have a low frequency of contact with the others influence the parasitic infestation. In conclusion, species-specific differences in parasites (helminths) were possibly related to the species' evolution in different habitats (Natalia et al., 2017).

An interesting finding explicit sex-specific differences between parasite diversity exist in wild cats. Reasons why male-biased parasitism occurs are hypothesized as either by ecologic or physiologic factors. These causes may be endocrine system, immune system, behavioral, territorial, movement, social or diet related. The association of testosterone and the immune system may cause a higher susceptibility to parasitary infestations in sexually

matured males in wildlife (Krone et al., 2008).

The burden of parasites depends on the length of time since the animals were taken from wildlife, how they are adjusted to captivity, quality of life in captivity, the proximity to other species with which they could interchange parasitary agents. Sources of infectious agents for captive carnivores include individuals of same or different species, humans, food, water, fomites and iatrogenic introduction (Williams and Thorne, 1996).

Endoparasitism results in emaciation, weakness, inappetence and produces predisposition to other secondary illnesses. The more parasitary infestations become a significant reason of losses, the more it's high time to organize detailed researches about the subject (Nimisha et al., 2017).

The most important part of fighting against wildlife diseases is to detect the early stages of a new disease; which is hard to realize since wild animals are very difficult to be found when died. This is what makes difficult to get the appropriate biological material for epidemiologic studies. In general, most of the studies concerning wildlife include either case reports or cross-sectional serologic surveys which form when reunited, a fragmentary data. Comparison between different data is problematic because of the different lab methods used and the pathogen selection which is generally arbitrary, opportunistic or determinate by the foundation. Thus, correlation between the infectious agent and the development of the disease necessities further information. This wide information consists of clinical examinations, necropsies and histopathologic evaluations (Furtado and Filoni, 2008).

Case

Clinical examination and findings

Three six weeks old tiger cubs of a circus, two of which were females and the other one was a male, were brought to the internal medicine clinic as soon as some complaints had started. The cubs were staying with their mother in captivity.

Upon arrival at the clinic, complete physical exam of each cub were performed. The examination started with rectal body temperature measurement. All animals' temperatures, heart rates and respiration rates were compared to domestic cats' reference values (Kahn and Line, 2005; Reilly et al., 2014). All of these values remained between normal intervals and didn't show any anomaly during the treatment.

External examination of eyes, ears, pelage, feet and claws followed by examination of oral cavity,

pharynx, gingiva pursued this first step. Lymph nodes and thoracic auscultation were also realized. No pathologic finding was found.

The first female cub was reported to have a slight diarrhoea. No anomaly except a slight abdominal sensitivity was observed. The second female cub was asymptomatic except smooth stool formation. The male cub was reported to have vomited twice. A slight diarrhoea also had been observed. Exam revealed a slight abdominal distension accompanied with mild abdominal sensitivity. Body weights were recorded for each cub. The first female weighed 3.8 kg., the second one weighed 4.3 kg. and the male's weight was 5.4 kg.

It is well known that *V. cephalica saphena*, *V. jugularis* and *V. femoralis* is used in order to collect blood in cats, dogs and non human primates. But in tigers, these areas are inconvenient since the blood collector must stand in front of the tiger; thus *V. caudalis* is safer and convenient when blood must be taken in a tiger (Shrivastav et al., 2011). Blood may also be taken from dorsal coccygeal vein (Sajjad et al., 2012). Yet, in this case, jugular venous blood samples for haemogram could be obtained as similar to one literature (Reilly et al., 2014). Blood samples were collected on the first day, at the end of first treatment period and on the last day of the second treatment period. The blood samples collected on the day the cubs had been brought to the hospital showed that only a mild anemia were present for the male cub. The abnormal values ameliorated as the therapy went on. Other cubs' haemogram values remained within normal intervals from the beginning to the end of the therapy.

Gaita samples for parasitologic examination were also collected. To maintain normal body temperature, the cubs were maintained in a warm, dry and clean environment as required during treatment in hospital.

Diagnosis and Treatment

Toxocara spp. was detected in first female and male cubs' stool samples. The gaita exam of the second female was negative. Dehydration was checked out for each cub by pulling up on the skin on the back of the neck for checking out whether the skin

does retract immediately or stays suspended.

None of the cubs exhibited dehydration. On the other hand, the first female cub and the male cub were supported with fluidotherapy since the first had a slight diarrhoea and the second had vomited twice apart from having had a slight diarrhoea. IV catheter was placed in medial saphenous vein for fluid administration so that fluid losses that may occur with ongoing diarrhoea and vomiting should be prevented. Lactated Ringer's solution were given (Hoskins, 2001; Reilly et al., 2014).

The male cub had been deprived of both food and water for 24 hours so that mucosal integrity restoration and more rapid return of gastrointestinal function realize (Hoskins, 2001). The vomitus discontinued on the second day and didn't reoccured.

The fluidotherapy was discontinued on the 3th. day as the cubs' diarrhoea turned into normal stool and the vomitus of the male cub had already ceased (on the second day) and normal feeding could be started by increasing gradually the amount of food and water (Hoskins, 2001).

Pyrantel pamoate (Kontil™; Hüsnü Arsan) was administrated 5 mg/kg. PO. for 5 consecutive days as suggested in literature (3-5 mg/kg. PO for 3-5 consecutive days) in all cubs. For the male cub, the administration of the drug started when vomitus ceased. Moreover as recommended in literature, follow-up treatments with the aim of remove larval stages was realized. The treatment was repeated 7 days later as recommended for domestic cats (Kahn and Line , 2005).

In order to support immune system which might be weakened due to parasitary infestation, to help prevent secondary infections and to combat anemia and weakness, vitamin B complex (0.5ml/day IM) (Dodex™; Vetaş) support was supplied during the first treatment period as agreed with Katona and Katona-Apte, (2008).

At the end of both first and second treatment periods, gaita samples were re-collected and re-examined. No parasites were found. The therapy was judges as successful.

Table1. Hemogram values of the male cub represented with abnormalities and amelioration during the treatment

Parameters	First day	The end of first treatment period	Last day of the treatment period
RBC (X 10 ⁶ /μL)	3.76	5.86	7.38
PCV (%)	21	28	32

Discussion

Gastrointestinal parasites recorded in tigers in a research are listed such as *Paragonimus westermani* (41.6 %), *Diphyllobothrium latum* (55 %), *Strongyle* sp. (6.6 %), *Taenia* sp. (10 %), *Trichuris* sp. (3.33 %), *Toxocara* sp. (3.33 %) and *Nematode* larvae (3.33 %) respectively (Arjun et al., 2017). Ascarididae nematodes, *T. canis*, *T. cati* and *T. leonina* are very important parasites of canids and felids. The large roundworms of dogs and cats, especially in kittens and puppies are common. Between *T. canis*, *T. cati* and *T. leonina*, the most important ones are *T. cati* and *T. canis* because they cause larvae migration in humans and *T. canis* may be lethal. Definitive hosts for *T. canis* are canidae and rarely feline species, definitive hosts for *T. cati* are felidae including tigers. In felids, co-occurrence of Both *T. cati* and *T. leonina* are detected. This co-occurrence seen both in domestic and wild felids is variable depending on climate, environmental conditions, age of the host and the season (Kahn and Line, 2005; Okulewicz et al., 2012). Roundworms may be acquired via four ways known as transplacental migration, mil-borne transmission, infective egg ingestion, paratenic or intermediate host ingestion (Leib and Monroe, 1997; Okulewicz et al., 2012).

In a survey conducted in a national park, three zoo parks and a circus, 31.25 % of the tigers were found to be parasitary infested. The tigers were kept in captivity only in one zoo, in the park and in the circus. The incidence of parasitary infestations were respectively 0 %, 33.33 % and 50 %. The high incidence observed in captivity was related to pasture contamination and close association of animals in captivity (Kashid et al., 2002). In captivity, the health status of the animals depends on feeding, keeping conditions, animal management, and environmental conditions including humidity and temperature. The staff may also transmit the infections through their shoes, clothes, hands, foods or working tools. Another transmission route is the animals themselves when being transmitted from one area to another; mixing different species brings additional infection risk (Atanaskova et al., 2011). In this case, all three cubs were living in a circus and in captivity with different animal species and with a huge amount of people. Thus, there were a multifactorial situation which may have influenced the contamination. Captive lifestyle makes it easy to get parasitary infestation in wild felids (Raja et al., 2014). First of all, the circus is mobile and keeps visiting various geographic areas with various animal and human populations and

various food and water sources. The species-species interactions might as well have played an important role in the cubs' infestation. The staff and all the tools around also must be taken into consideration.

Roundworm infection should be suspected in all puppies and kittens (Leib and Monroe, 1997). In cats and dogs, infection is diagnosed by detection of eggs in feces (Kahn and Line, 2005).

In this case, three cubs' scatologic analyses revealed *Toxocara* spp. The disease was managed to be detected in early stage. This result was confirmed by the literature revealing *Toxocara* spp. as one of the most often detected parasitary agents in both free and captive wild felids (Krone et al., 2008; Marathe et al., 2002; Nimisha et al., 2017; Okulewicz et al., 2012). The negative result of fecal examination doesn't proof the absence of a parasitary infestation. The most important part of fighting against wildlife diseases is to detect the early stages. Parasites are the most frequent reason why gastrointestinal diseases occur. Parasitary reason must be taken into consideration in puppies and kittens. This is why it is very important for the staff to observe even a little change in animals' routine. In this case, three cubs were brought for treatment as soon as the signs had been noticed (Furtado and Filoni, 2008; Hoskins, 2001, Leib and Monroe, 1997).

Scatology is a non-invasive, easy and cheap way to gain information about parasitary infestations of free-ranging wildlife's individuals. Wild animals' faeces being the most significant sign of their presence, the faeces of carnivores contain anal glands secretion which represents specific properties in every species. The gaita produced by each individual varies with age, ingested food, this individual's absorption capacity and health situation. But, due to the difficulty to study parasite dynamics of wildlife, little information exists about the subject (Gorman and Trowbridge, 1989; Marathe et al., 2002; Chame, 2003; Arjun et al., 2017). In this case gaita analysis provided a fast, non invasive and reliable diagnosis method.

Wild felids may hide clinical signs of illness until the disease becomes severe. This is why it is vital that the staff be astute to subtle behavioural and physiologic changes suggesting any pathology. Any change in appetite, urination, defecation, hair coat or mucous membranes the dryness of which shows dehydration, breathing pattern or general behaviour must be carefully observed.

Many infected animals suffering this parasitic infestation remain asymptomatic. The first indications in young animals are lack of growth and loss of

Table 2. Normal values of the RBC and HCT represented with abnormalities in the male cub (In tigers)

Parameters	Duncan and Prasse, (1986)	Shrivastav and Singh, (2012)	Macree and Ramsay, (2013)	Sajjad et al., (2012) (Lahore Zoo)	Sajjad et al., (2012) (Lahore Wildlife Park)
RBC (X 10 ⁶ /μL)	5-10	4.66 - 9.15	--	9.60 - 11.0	7.64-12
PCV (%)	--	36—45	31.8 - 49.2	59.6 - 65.46	46.46 - 66.23

condition. Vomiting, diarrhoea, abdominal pain, pot-bellied appearance and failure to thrive, showing a dull coat are most common signs. In the early stages of the disease larvae migration may cause eosinophilic pneumonia which may be associated with cough. Cough, fever, mucopurulent nasal discharge and respiratory distress can accompany extensive larvae migration. Mucous containing diarrhoea may be observed. Worms are either vomited or seen in the feces. Cortical kidney granulomas containing larvae also are noted. Intestinal obstruction may realize occasionally. Heavy infestations may lead to stillbirth or pneumonia in newborns. These severe infestations result in verminous pneumonia, ascites, fatty liver and mucoid enteritis. *Toxascaris leonina* differs from the others; severe clinical signs may be detected in prepatent infections; thus diagnosis must be based on anamnesis, signalement and physical examination. Eosinophilia may also be present (Leib and Monroe, 1997; Kahn and Line, 2005).

In this case one female cub was asymptomatic while the other two were representing the signs that could have been detected in early stages. All were in concordance with the literature.

There are many well-known anthelmintic used against roundworms. In cats, drugs licensed for the disease's treatment are listed as dichlorvos, diethylcarbamazine, fenbendazole, flubendazole, mebendazole, piperazine, pyrantel, selamectin and the combination of praziquantel/pyrantel. Despite not being approved in cats, pyrantel pamoate use (20 mg/kg.) is safe and efficacious. Heartworm prevention provided by milbemycin or selamectin is also effective to control ascariasis in cats. Kittens can be treated several times at 2- to 3- week intervals up to 3 to 4 months of age. In cats piperazine should be used as 55-62 mg/kg. PO. The patient should be re-treated 10 days after first cure. Another cure choice is to use piperazine hydrate, 80-100 mg/kg. PO. Praziquantel may also be used as 5 mg/kg. PO. or 5.68 mg/kg. SC, IM. A pyrantel dosage of 20 mg./kg. PO is another choice. The treatment must be repeated 7-10 days later. Another dosing schedule may be organized as 5

-10 mg./kg. PO and re-treatment 2 weeks later is necessary (Kahn and Line, 2005). The prognosis for dogs and cats are excellent. Yet, mixed infections with other parasites (especially with hookworms) or viral infections may worsen the situation. On the other hand, dealing with human infection is a serious challenge since environmental contamination is generally occurred by the time puppies or kittens are first presented to vet (Leib and Monroe, 1997).

In tigers the most often identified species are Ascarididae and Strongyloidae (*Toxocara*, *Toxascaris* and *Ancylostoma* spp.). A total parasitary elimination in tigers is barely possible. Yet, the parasites may be controlled with the help of periodic oral anthelmintic administration.

Anthelmintic use is found to be more effective when full recommended dose is administrated more than one day. A three consecutive days' treatment schedule instead of adopting a single day treatment is suggested. Follow-up treatments with the aim of remove larval stages is also recommended. Post treatment fecal exams are necessary in order to evaluate the efficacy of initial cure. All animals' feces must have two follow-up exams at weekly intervals 1-2 weeks post therapy. Routine monthly heartworm prevention treatment is suggested year-round. A fecal exam for all animals must be provided every six months. In this case the staff were warned about follow-up treatments, routine prophylactic antiparasitic administrations, lifestyle conditions and hygiene necessities.

Table 3. Normal values of the haemogram parameters represented with abnormalities in the male cub (In domestic cat).

Parameters	Kahn and Line (2005)	Sodikoff, (2001)
RBC (X 10 ⁶ /μL)	5-10	--
PCV (%)	30-45	26-45 ^b
		30-45 ^c
		20-25 ^d
		15-19 ^e
		10-14 ^f
a: 5-to 6-wk-old kittens. b: < 6 Months. c: Adults, d:Mild anemia, e: Moderate anemia, f: Severe anemia		

The effective and safe anthelmintics for tigers are listed such as; febantel (6 mg/kg. PO, once a day for 3 days; re-treatment in 2 weeks); fenbendazole (5-10 mg/kg. PO; 3 consecutive days); ivermectin (0.2 mg/kg. SC/PO) (an injectable cattle dose may be used orally at this dose for 1-3 days. Limited use is suggested in tigers via parenteral route); praziquantel (5.5-6.6 mg/kg.; either PO or parenteral form for cestodes); pyrantel pamoate (3-5 mg/kg. PO for 3-5 consecutive days); sulfadimethoxine (50 mg/kg. PO or parenteral for coccidiosis). Pyrantel pamoate administration was useful in this case.

It is also important to take into consideration that most endoparasites detected in tigers are relatively common and ubiquitous in ex situ conditions (Bush, et al., 1987). Not all larvae or eggs found in fecal examination may be parasitic to the tigers. Because tigers serve as a transport host depending on what they had been fed with; which highlights the importance of the diet. Yet in this case, *Toxocara* known to be pathogenic and ongoing with gastrointestinal symptoms was successfully treated.

Parasites alter their hosts' survival and reproduction either directly by pathological influences (blood loss, tissue damage, spontaneous abortion, congenital malformations, death) and indirectly by diminishing the host's immune system and affecting the physical situation. In addition, some parasites are zoonotic (Thawait et al., 2014). In this case no symptoms had occurred except some mild gastrointestinal signs in two cubs and mild anemia in one. This was probably because the disease had been detected in an early stage.

Since pathogens alter normal physiology, bloodwork interpretation is a useful tool for health evaluation (Shrivastav and Singh, 2012). Although data about haematological and biochemical parameters of wild animals is meagre, some explications about blood values of captive tigers was published (Sajjad et al., 2012). Domestic cat hemogram reference values also can be used in order to evaluate tiger clinical pathology (McRee and Ramsay, 2013).

Though CBC alone is never accepted to confirm totally the presence or the absence of any infection or infestation, it is a useful tool in order to identify whether the nature of the disease is bacterial, viral, fungal or parasitic (Khan et al., 2015). The changes noted in various haemogram findings may be useful in diagnosing the disease and in evaluating the prognosis (Sajjad et al., 2012). In this case only a mild anemia was noted in one female cub. The mild anemia was thought to be related to the infestation and could be

normalized with appropriate therapy. WBC measurements which remained always within normal intervals didn't show any secondary infection.

The therapeutic management of parasitic infections in captive wild felids mainly consists of drug application targeting the specific parasite (Sur et al. 2001). But environmentally resistant larvated eggs form the main problem since they are the main infection reservoirs. The ways how to reduce perinatal transmission or minimize egg output are listed (Kahn and Line, 2005). Especially in unnatural environments such as zoos, the transmission of *Toxocara* spp. and *Toxascaris* occur inter alia by rodents. Moreover, the infections may be persistent. Although the initial treatment leads to an elimination, the parasite is re-detected after two months. A report explicates *T. leonina* persistence in tigers both in autumn-winter and spring-summer periods while another one reveals a re-infection occurred in lions after 30 days of treatment in a zoo. *Toxocara* spp. and *T. leonina* elimination from zoos is very difficult (Oculewicz et al., 2012). In this case the appropriate anthelmintic deworming provided an effective cure. The follow-up scatologic exams were negative. Yet, as suggested by the literature and as agreed with it, it was recommended to the staff to regularly realize parasitary prophylaxis and gaita exams for all species living in the circus. Or as a better choice, to take the wild species to wildlife, at least to a zoo park where they belong.

Infections because they may enter adjacent territories and either eat anything found or come in contact with domestic species from which they take infectious agents (Shirbhate, 2007).

As an apex predator, the tiger is accepted as an indicator of healthy ecosystems. Thus a significant decrease in tiger population will devastate ecosystem. This is why their protection is very important. Because of being an apex predator the parasitary diversity and load in tiger is likely to be higher compared to the other higher vertebrates (Arjun et al., 2017).

Zoo gardens exhibit wild animals for various reasons such as aesthetic, educational and conservation purposes. Zoos, sanctuaries and wildlife parks, the main of which are protecting endangered species also serve as a seat of education, research and recreation. But human-made environments are not suitable for wild animals to carry out their instinctive behaviours and they hence result in physiologic and homeostatic alterations (Sajjad et al., 2012). Especially helminth infestations play a major role in parasitary

diseases and they may even result in death. In their natural wild habitat the animals may gain a natural resistance against parasites or live in balance with their parasites while in captivity, the altered environmental conditions damage the animals' ecology and may increase their sensitivity against parasitary infestations. The wildlife which is well adapted to parasites lacks in adapting to adverse effects of parasitism (Goossensa et al., 2005; Borghare et al., 2009; Thawait et al., 2014). Wild animals living under natural conditions have evolved to develop resistance to parasitic diseases in a way that parasites co-evolved with their host and wouldn't cause much overt diseases (Gairola, 1986). Apart from playing a major role in population regulation, parasites have other powerful effects such as parasite mediated host competition, sex and sexual selection, social behaviour including xenophobia and sexual fidelity, foraging strategies and predator prey interactions. When it comes to tiger populations, parasites have a twofold influence. First of all, animals which are deprived of predatory pressure have greater parasite loads. Between all species, tigers show maximum load. Such a huge amount of parasites impacts deeply the health status, behaviours and reproductive success of the individual. Moreover, parasites influence the cub mortality, the most important factor of population growth. Secondly, parasites with an intermediate host as a prey species and with a definitive host as a predator, influence predator-prey dynamics (Marathe et al., 2002).

Detailed epidemiological studies targeting parasites of the felids, regular faecal examinations, improvement of parasite identification techniques and the use of novel methods such as molecular techniques supplemented with post mortem findings when necessary, effective drug use with wide safety

margins targeting a specific parasitic species, better management practices such as routine cleaning and disinfection, correct disposal of waste and clean food presentation should be adopted wisely as each one plays an important role in reducing parasitary infections in captive wild animals (Mougil et al., 2015). According to some authors, parasitic diseases are the main reason why wild animals in captivity die (Rao and Acharjyo, 1984). This is why establishing precautions and appropriate treatment protocols against these infestations are of crucial importance (Atanaskova et al., 2011). If parasitic infestations are to be prevented, effective precautions such as appropriate antiparasitic treatment, increased hygiene, good animal and staff management, regular parasitary controls of food and water, quality food, appropriate vitamins and vitamins supplement need to be organized. It is also important to take into consideration that every parasitary treatment may cause stress and increase the possibility of infection (Atanaskova et al., 2011; Borghare et al., 2009).

The best approach that could be adopted would be an interdisciplinary one interconnecting population, geographic, etiologic, pathologic studies. Such a perspective obligates reuniting biologic, clinical, geographic data while monitoring closely the diseases and using the appropriate diagnostic techniques. Adequate worker, laboratory equipment and constant funding are also very important (Furtado and Filoni, 2008).

As a result, wild species must live in their natural habitat, not in captivity for any reason. Appropriate researchers, veterinarians, biology and veterinary education, staff and budget must be provided so that their extinction could be prevented and their health problems could be both prevented and managed.

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