Intestinal Parasites Found in Fecal Samples of Wild Cats of Costa Rica

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**ABSTRACT**

A parasitological study of 623 fecal samples of 616 wild felines or of 65 in cautivity was performed. The samples came from the species Panthera onca, Leopardus pardalis, Puma concolor y Leopardus wiedii and we found several evolutionary forms of at least one parasite, in 37% of the samples studied. This material was collected in 5 regions of Costa Rica, named as Chorotega, Central Pacific and Brunca from the littoral pacific, Huétar Atlántica from the Atlantic littoral and Huétar Norte in the North and a Central region in the center of the country. Most of the samples were found in littoral regions where there are more mountainous and wooded areas and a major percentage of parasite infection was observed in the Atlantic and Brunca regions. Eggs of Paragonimus sp., Toxocara sp., Alaria alata and larvae of Strong lids were found in the animals, independent if they were in captivity or not. Species of some of these Genera also infect human beings, therefore the importance of these findings for human health and of course, for the exuberant biodiversity of Costa Rica, is discussed.

**Key words:** Parasites, Wild cats, Species, Costa Rica

**INTRODUCTION**

There are not too many Information about the intestinal parasites in wild cats, in animals from Central America, including Costa Rica. In this country, we have several well-documented species: Panthera onca (jaguar), Puma concolor (Puma), Leopardus pardalis (ocelote), Leopardus wiedii (margay), Puma yagouaroundi (Jaguarundi). In other countries, some of these species were studied and many parasites were found in those felines. For example, Aranda et al. (2012), studying animals in captivity, found Spirometra mansonioides y Toxocara cati among other parasites. Martinovic et al. reported the presence of Taenia taeniformis, Capillaria sp., Toxocara cati, Alaria alata and Toxascaris leonina between others, in Felis silvestris silvestris, wild cats killed in traffic or provided by hunters. Paragonimus sp and other helminths has also been reported in these felines in Croatia (Patton & Rabinowitz, 1994) in Ukraine, (Varodi et al., 2017), in Ecuador (Lopez Crespo et al., 2017) and in Italy (Napoli et al., 2015). In Costa Rica, there are several reports about paragonimiasis published by Brenes-Madrigal et al., (1982, 1983) but we do not find any studies with fecal samples of wild cats. Most of the studies in felines have been performed with domestic or stray cats (Nagamori et al., 2018), where the relation with human beings in the health point of view, has been discussed. Following the same line, and under the knowledge that some wild cats also carrier parasites which eventually could produce human diseases, we think that it is important to know the species of that organisms present in these wild felines. We do not forget that hunters capture these animals in order to obtain their beautiful furs, with the correspondent possibility of contamination. In addition, in those parasites as Paragonimus sp. where snails, water and finally river crabs are involved (Brenes et al., 1980), waters can be contaminated by the eggs excreted in the feces; river crabs sometimes are eaten by people. Based in of all these considerations, the aim of this work was to determine the organism that can be found in the fecal material of the wild cats from Costa Rica, on relation to the importance in public health. Moreover, since we also know that the felines can be affected by some of the parasites, we hope that this study will be a contribution in the biodiversity point

of view. Therefore, and taking advantage of a genetic study, dedicated to identifying feline species by means of feces, we studied the parasites present in those stool samples.

**MATERIALS AND METHODS**

**Study regions and sample collection:** Samples were collected around of Costa Rica territory, including different regions and places (Figure 1, Table 1). Most of them were found in wild environment and a few in captivity cages (Figure 2) and a genetic identification was done. Non-invasive methods were used to collect scat samples from different protected areas and their surroundings in Costa Rica, which were collected opportunistically with collaboration of researchers and organizations that contribute to *in situ* felid conservation. A trained dog was also used to localize wild feline feces. Each sample was collected in individual resealable bags containing a label with the name of field collector, geographic positioning system (GPS) and date. The sample was delivered at room temperature to the Genetic Conservation Lab (Lab Gen Con) at UCR as soon as possible. The scat samples were dried using silica beads and stored at room temperature or -20°C for UCIMED. Scats samples were refrigerated until their study. Aliquots were taken advantage of a genetic study, identifying different feline species by means of feces, we focused to the presence of these organisms. As we observed in the regions with more samples, *P. onca* was frequently in Huetar regions, *L. wiedii* in North Huetar and Central regions. More specific, most of the samples came from Limón and surrounding places, as well as research centers, to use as reliable known species.

**Laboratory studies:** As soon as received, the samples were refrigerated until their study. Aliquots were suspended in 0.85 % saline solution and D’ Antony iodine solution for the microscopy study. Some of the material was concentrated under the Telemann technique and studied again. Intestinal smears were prepared for the Koster, Ziehl-Nielsen and Weber stains, looking for Cryptosporidium, other coccidia and microsporidia, respectively.

**Statistical analysis**

For the statistical analysis, simple frequency tables, association or contingency tables, percentages and the chi-square test were used.

**RESULTS**

**Animal distribution:** Most of the samples came from the feline species *Panthera onca* and the other samples corresponded, in similar number, to *Leopardus pardalis, Puma concolor* y *L. wiedii* (Figure 3). Regarding to the geographic distribution, a major number of them were collected from the Atlantic Huetar region, followed by Brunca region with an important percentage as related to the other regions (Figure 4). In Figure 5 is showed the distribution of the samples according to the region and the animal species. As observed in the regions with more samples, *P. onca* was frequently in Huetar regions, *L. pardalis* in Brunca region and *Puma concolor* in North Huetar and Central regions. More specific, most of the samples came from Limón and surrounding places, as well as from Osa (Table 1) Anyway, these three species were present in almost all regions.

**Parasites finding:** At least one parasite was found in 37% (229 samples) and the distribution of positive and negative samples, either in wild or captivity animal is shown in Table 1. Relating to the parasite presence, *Paragonimus* eggs were more frequent, followed by *Toxocara*, and *Alaria*, and some other parasites in a minor quantity (Figure 4). However, the presence of *Toxascaris leonina, Spirometra mansoni* and *Capillaria* sp. is interesting due to the novelty of the information.

**DISCUSSION**

Since the samples were collected and preserved for some time, only helminths were reported in this study. Therefore, any comparison with other works will be focused to the presence of these organisms. As we expected, the major number of samples were found in places of the Huetar and Brunca regions which are the more wooded areas. Comparing our results with those of other authors, we observe that strongilids were found in all of them, but other parasites as *Alaria alata*, was reported only by Martinkovic et al. (2017) in a study in *Felis silvestris silvestris* done in Croatia. *Paragonimus* sp., was reported only in Thailand in the leopard (*Felis bengalensis*) and tiger (*P. tigris*) (Patton & Rabinowitz, 1994). Since the genus...
Fig. 2: Distribution of the fecal samples collection according to the regions and the feline species studied.

Fig. 3: Feline fecal samples distribution according to procedure and parasite species found.

Fig. 4: Parasite species distribution of feline fecal samples.

Fig. 5: Parasite species according to the feline specie (286 samples).
Paragonimus has some species that parasite human beings, this finding in Costa Rica is very important in the medical point of view. In fact, Brenes et al., 1984, in a review, reported, at that date, the human cases found, in Central America countries and several regions of Costa Rica. Additionally, there are several studies in Costa Rica dealing with the epidemiology and the life cycle of this parasite. Paragonimiasis is an important disease that usually causes lung problems and occasionally, some erratic localization increased the symptoms affecting the human health in a major degree (Brenes et al., 1982, 1983). As we observed, this parasite was the most frequent in the fecal samples of the three predominant feline species; this means that in Costa Rica these animals could be very important reservoirs of this parasite.

Toxocara sp, other important parasite present in samples of the studied species, is an interesting finding. This organism has been reported infecting some felines species in several works performed in other countries (Patton & Rabinowitz, 1994, Aranda et al. 2015, Martinkovic et al. 2015, Varodi et al. 2017); however, in Costa Rica there was not any complete information about it. Toxocara sp. is important because could eventually produce some types of visceral larvae migrans that in human beings, cause an important disease, especially with lung and liver infection (Zinkham et al., 1978). Alaria is other interesting parasite because some studies have demonstrated the action of some evolutionary stages that produces lesions, especially in eyes and other organs of humans (McDonald et al., 1994, Wasiluc, 2013).

As other authors, already cited, we also have found in very low percentage, in the fecal samples, eggs of Spirometra mansonioides, Toxascaris leonina, Capillaria sp and Taenia sp (probable Taenia taeniaeformis). Larval stages of the first one has been found producing in human beings the sparganosis syndrome (Tran Le, 2017). S. mansonioides have been founds also in a domestic cat from Costa Rica (Valerio et al., 2005). The other parasites are important in the veterinary point of view.

Conclusions

It is demonstrated that costarrican wild cats harbor many intestinal parasites, some of which can eventually, cause human infection representing an important zoonotic relationship than affects the epidemiology of the human health in Costa Rica. In addition, in the scientific point of view, this knowledge is a contribution in order to help the conservation of the zoological national and world biodiversity.

REFERENCES


