Incidence of Gastrointestinal Parasites in Snakes around Kainji Lake National Park, Nigeria

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Abstract

Parasites are important biotic factors that lower the populations of animals in the wild. Parasitic infections can affect host well-being and reproductive potentials, therefore knowledge of the parasites of snakes will enable their conservation. This study aims at determining the prevalence of gastrointestinal parasites of snakes. The incidence of gastrointestinal parasites in twenty four captured snakes from Kainji Lake National Park in Niger State, Nigeria was assessed using sedimentation method to ascertain the presence of ova and oocysts. Coprological examination showed that 66.7% of the snakes sampled were infected with one or more parasites. However, 41.7% of the snakes were infected with a single parasite, while 25.0% had multiple infections. Columbridae family had the highest prevalence followed by Elapidae and Viperidae with prevalence of 75.0%, 66.7% and 62.5%, respectively. Parasites recovered from the snakes were Kalicephalus spp. (3.3%), Pentastomum spp (25.0%), Strongyloides spp. (8.0%), Hymenolepis spp. (8.0%), Ascaridia spp. (8.0%), Strogylidia spp. (8.0%), Oxyuridia spp. (4.0%), Ophiascaris spp. (4.0%), Choleoeimeria spp. (4.0%), Polydelphis spp. (4.0%), Armillifier spp. (4.0%), Hexametra spp. (4.0%), Caryospora spp. (4.0%), Isospora spp. (4.0%) and unidentified species (4.0%). The observed parasites in the examined snake populations were highly relevant, as some of the parasites were not only zoonotic but could also endanger snakes in the wild.

Keywords: Gastrointestinal parasite, Prevalence, Snakes, Wildlife.

Introduction

Snakes have become increasingly common domestic pets. While several reptile species sold as pet animals are bred in captivity, most of them are taken from the wild or offspring of wild-caught parents. Reptile populations including snakes are facing a global decline (Gibbons *et al.,* 2000; Klemens, 2000). Although habitat loss and degradation have been cited as the primary factors, disease has also been mentioned as one of the potential causes. Diseases and parasites have been neglected and often considered to have a limited role in reptile ecology, but there is increasing evidence of effects on individual and population biology (Spalding *et al.,* 1993). Many helminths, which include nematodes, cestodes and trematodes, are parasites of reptiles (Hoff *et al.,* 1984). Helminths species of the same group (Phylum, Class, Order, Family), or from different groups, can be found simultaneously in the same individual or population, and the helminth community composition can differ between host populations and habitats (Goldberg *et al.,* 1998). Factors such as host age, diet, thermoregulatory behavior, and season have been shown to influence the parasite community in snakes (Rau *et al.,* 1980). The zoonotic potential of these parasites cannot be undermined, more importantly because the majority of zoonotic parasites of humans have been known to emanate from wildlife parasites (Taylor *et al.,* 2001). For example Pentastomiasis, otherwise known as tongue worm infection, is often found in snakes, and it has been reported in Nigeria (Ayinmode *et al*., 2010). The beddings of captive snakes are often infected, and if preventive measures are not well-considered, transmission of parasites from occupational hazards may occur. Nigeria has a large population of snakes, but the species diversity and parasitic burden has not been extensively studied. This study was undertaken to identify prevalent gastrointestinal parasites in wild-caught snakes around Kainji lake National Park.

Materials and Methods

Study area and Sample Population

Kainji Lake National Park (KLNP), Niger state has three segments, a part of Kainji lake where fishing is prohibited, Borgu game reserve to the west of the lake and Zugurma game reserve to the southeast (UNEP, 2010). The coordinates of Kainji Lake National Park are latitude 10° 22' 06"N and longitude 4° 33' 17"E in North central of Nigeria. The National Park covers a total area of 5340.82km^2 and was established in 1978. The snakes for this study were pooled from three locations in the buffer zone around the lake and a total of 24 snakes were collected and examined.

Ethical Approval

The study was conducted with the permission of the Kanji Lake National Park Animal Ethic Committee (NPH/GEN/121/XIII/100) and in line with the guidelines of the committee.

Collection and examination of faecal samples

Twenty four killed snakes were collected from the villages around the Park, the snakes captured alive were released into the wild in the Park. The twenty four snakes were identified, fixed in 10% formalin and packed in bottles according to their families. The intestine and rectum were located and dissected; thereafter the contents were collected by scrapping. Intestinal and rectal contents were collected from the snakes into a suitable container and 2.5 g was thoroughly mixed with 10 mL of saturated saline solution. The emulsion was filtered through 1.0 mm aperture sieve into a conical centrifuge tube. The eggs were further cleaned from organic debris by centrifugation at 1200 rpm for 5 min in a centrifuge (Uniscope laboratory centrifuge SM112, Surgifriend Medicals England). The supernatant was decanted and the sediment was washed with 10 mL of saline solution. This process was repeated until the supernatant was clear. After the last wash, the supernatant was decanted and fixed by adding 10 mL of 10% formalin to the sediment for 5 minutes. The sediment was mixed and centrifuged at 1200 rpm for 5 min. The formalin was carefully decanted and the remaining sediment with small amount of the fluid was stirred with a pipette. One drop each of the sediment and iodine was transferred to a glass slide and covered with a coverslip and examined microscopically at X40 magnification on an Olympus Microscope for the presence of parasites. Parasite ova and cysts were identified using standard morphological characteristics (Radhakrishnan *et al.,* 2009).

Statistical analysis

Data were processed using Microsoft excels and checked for errors. Percentage occurrence of parasites in snake families was calculated.

$$\text{Percentage occurence} = \frac{Number\ of\ snake\ infected\ parasite\ specie}{Total\ number\ of\ snake\ sampled} x\ 100$$

Results

Three families of snake were identified. Two genera was observed in the Elapidae (*Naja nigricolis* and *Dendroapis jamesoni*), however, one genera with two species was observed in Columbridae (*Boaedon lineatus* and *Boaedon virgatus*), and one genera was also found in the Viperidae family (*Bitis arientans*). Ova and cyst of helminthes and protozoan respectively, were recovered from the snakes.

Oocysts of intestinal protozoans identified as *Isospora spp.* (Figure 1G) 4% and *Caryospora spp.* (Figure 1V) 4% were found in *Boaedon lineatus* and *Boaedon virgatus,* respectively. Adult worm of *Ascaridia* sp. (Figure 1N) and *Pentastomum* sp. (Figure 1T) were found in three snakes from the Viperidae family. *Kalicephalus* sp. (Figure 1M) was observed in all the three families of snakes examined (Table 1; Figure 1L) with the highest incidence of 33.3%. A 4% incidence of *Strongyloides* sp. was observed (Table 1) and of the 24 snakes examined 25% were infected with *Pentastomum* spp., and the highest prevalence was observed in the *Viperidae* family (Table 1). The incidence of *Ophidascaris* sp. (Figure 1U) was 4% (1/24) (Table 1). *Oxyuris* spp. (Figure 1I) was also recovered from *Bitis arientans* (Table 1). *Hymenolepis species* (Figure 1L) was isolated in 8% of the snakes examined (Figure 1). All the *Naja nigricolis*, a common snake of the *Elapidae* family examined were infected with at least one parasite (Table 1). Single infection of snakes was 41.7%, while 25% of the snakes had multiple parasite infections (Table 2). Each of the snakes in the *Viperidae* family was found to harbour 2-4 zoonotic parasites.

Table 1: Parasite Summary in the Snake Families Examined

Snake families	Number of snakes (*n=24*)	Number of snakes infected	Types of parasite species[a].
Elapidae			
Naja nigricolis	2	2	*Kalicephalus* spp*, Choleoeimeria* spp
Dendroapis jamesoni	1	0	
Columbridae			
Boaedon lineatus	7	5	*Pentastomid* spp. (2)*, Kalicephalus* spp (4)*, Isospora* spp*, Strongyloides* spp*, Hymenolepis* spp*, Hexametra* spp
Boaedon virgatus	1	1	*Caryospora* spp
Viperidae			
Bitis arientans	13	8	*Pentastomum* spp. *(4), Kalicephalus* spp (3), *Polydelphis spp, Hymenolepis* spp*, Strongyloides* spp*,* Strongylid ova (2), *Armillifier* spp*,* Q- unknown, Ascarid (2), *Ophiascaris* sp., Oxyuridia

[a]Figures in parentheses indicate the number of snakes infected with each parasite.

Table 2: Prevalence of parasitic infection in wild-caught snakes

Host	Total host screened. *n = 24*	Host(s) with single infection.	Host(s) with multiple infection.	Total prevalence of parasites (%).
Elapidae				
Naja nigricolis	2	2	0	8.33%
Dendroapis jamesoni	1	0	0	0%
Total				
Columbridae				8.33
Boaedon lineatus	7	2	3	2.83%
Boaedon virgatus	1	1	0	4.17%
Total				25%
Viperidae				
Bitis arientans	13	5	3	33.33%
Total Prevalence		41.67%	25%	66.67%

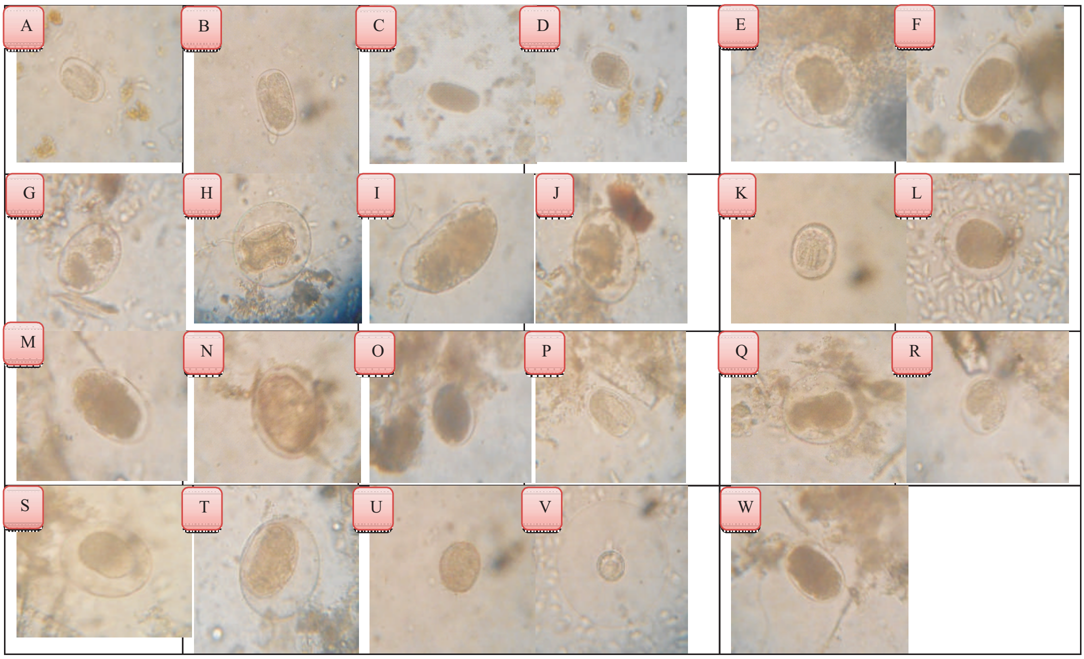

Figure 1: Parasite ova and cyst under light microscopy (x100) : A &B- *Strongyloides* species, C & D- Strongylid, G- *Isospora* species, M- *Kalicephalus* species, W- *Sarcocystis* species, H- *Armillifer* species, P- Spirurid, N - Ascarid, V- *Caryospora* species, I- Oxyurida, F- Unsporulated *Choleoeimeria* species, K- *Polydelphis* species, S- Pentastomid (*Porocephalus* species), T, Q & E- Pentastomid (other species), L & J- *Hymenolepis* species, U- *Ophidascaris* species, R– unknown

Discussion

Nematode parasites of wild animals have important role in human health because some species are zoonotic. Detection of gastrointestinal parasites in snakes can only be successful, if they are subjected to periodic faecal screening, which is only possible for captive snakes (Siquiera *et al*; 2009). However, these parasites are often recovered from necropsy and only few cases have been reported. Different species of *Kalicephalus* (Diaphanocephalidae) were found in the same host and it is known to be a zoonotic parasite which invades the gastrointestinal tract causing haemorrhagic lesions (Frank, 1981). It is also capable of causing transcutaneous infection, intestinal perforation and caseous enteritis (Grego *et al.,* 2004). In the present study, *Kalicephalus* spp. was found to be more abundant especially among the venomous species of snakes; this was also observed in a study in Thailand (Chaiyabutr and Chanhome*,* 2002). Children playing around the buffer zone could be predisposed to *Kalicephalus* spp. because of its transcutaneous zoonotic potential. This is because children walk around and play barefooted and not well covered with clothing. The high incidence of parasites in snakes (66.7%) from this study, poses a serious health risk to the community around the park because the environment could be contaminated with ova and larvae of parasites. *Pentastomum* spp, the second most prevalent parasite has been reported in snakes in Nigeria (Ayinmode *et al.,* 2000) and this parasite could be transmitted to humans if undercooked snakes are consumed. Odeniran and Ademola (2016) observed in their review article that *Armillifer* and *Linguatula* species were the most common species. Hence better control practices are needed to minimize contact between snakes and humans.

In this study, ova that are typical of the snake's prey were observed. The presence of *Hymenolepis* spp., which appears to be a pseudoparasite, makes diagnosis more complicated. Frank, (1981) reported that the wild-caught snakes shed parasites frequently, thereby raising concerns of whether the parasites ova reported are that of the snake or those of their prey. *Ophidascaris* spp. found in this study is a well-known parasite of snakes (Lane *et al.,* 1996), *Strongyloides* spp. (Family: *Strongyloididae*) are mostly found in snakes and feed mainly on blood (Anderson, 2000) and it provides a subtle nature of reinfection, by-passing the oral route and hence making the snake to be overwhelmed with parasites unnoticed. *Oxyurid* nematodes (pinworms) are common parasites of reptiles except crocodilians (Lane *et al.,* 1996), and are usually monoxenous and host specific (Frank 1981; Anderson 2000). Their pathogenicity is generally low but they can be debilitating when they occur in exceptionally large numbers (Frank, 1981).

The high incidence of parasites in snakes in this study could suggest lack of wildlife monitoring in the study area and should create an urgent need to understand parasitic fauna of wild-caught snakes from this region. The proximity of the park to the communities around the park could also suggest an urgent review of antiparasitic programmes in all the wildlife parks in Nigeria. This study reports the first prevalence of gastrointestinal parasites of snakes in Niger State, Nigeria.

Conclusion and Recommendations

The parasitic burden of wild-caught snakes in this study was quite high. Hence, soil samples from communities around wildlife parks should be routinely examined for parasites and strategic control programme established. Therefore, strategic parasite control should be targeted employing anthelmintic / antiprotozoal drugs.

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