Study report

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Project title: Impact of endogenous conservation measures on the diversity of blood and enteric parasites of crocodiles in Burkina.

Introduction

Host/parasite relationships are the result of coevolutionary processes. Parasites, in the ecological sense, include viruses, bacteria, protozoa, helminths and arthropods. The physiological and behaviours strategies implemented by both parasites and hosts to maximize their respective selective value are guided by the environmental context in which the host-parasite system evolves. Current climatic and anthropogenic changes favour spatial and temporal cohabitation between humans, domestic animals and wildlife. These interactions play an important role in the circulation of parasites between host species, and appear to be involved in the emergence of diseases associated with these parasites. Crocodilians are privileged actors in domestic/wildlife interactions because of their habitats, their growing populations, and especially their socio-cultural importance in a country like Burkina Faso. Indeed, crocodiles in some natural water bodies are considered by some lineages as a totem. Crocodiles show an unusual docility towards humans. This even constitutes a tourist potential that is exploited as such in some regions of the country (Sabou in the Boulkiemdé province, Bazoulé in the Kadiogo province) (Belemsobgo; 2007). In some areas (South-West, West), people are fond of crocodile meat and appreciate its skin. In the villages along the Wahablé and Navrikpê lakes, 20-25% of men eat crocodile (Zida 1995).

Zoonoses, which account for approximately 75% of emerging infectious diseases worldwide, constitute a new threat to public health (Pal 2013; Nusirat, Olaniyi et al. 2019). The cohabitation of these crocodilians with humans and domestic animals is notably dependent on the spatial behaviour of wild individuals, which can modulate direct or indirect contacts of potential health importance(Froeschke and Matthee 2014). Crocodilians, because of their particular situation as super predators and scavengers of terrestrial and aquatic prey, contract numerous parasitic infections from these prey and carrion, which have various zoonotic potential and associated risk (Kwak, Foo et al. 2019; Simulundu, Ndashe et al. 2020). The conservation of this charismatic species of socio-cultural importance requires a better understanding of their adaptability to the anthropisation of the environment, especially as these reptiles, in contact with humans, are also exposed in return. It is therefore urgent to

define systems for controlling crocodile-related zoonoses. However, there is very little information on the parasites circulating in crocodiles in Burkina Faso. This study aims to contribute to the study of the intestinal parasite fauna of crocodile populations in Burkina Faso.

Objectives of the study

The general objective of this study was to highlight the impact of the degree of anthropisation on the diversity, abundance and ecology of endoparasites circulating in the crocodilian populations of Burkina Faso. Specifically, the aim was to: (1) to inventory the endoparasites circulating within the crocodile population in urban (highly anthropised) and rural (moderately anthropised) environments in Burkina Faso; (2) to study the diversity, abundance and ecology of zoonotic endoparasites according to the sites**.**

Methodological approach

Study sites

Two wetlands were selected for this study because of their status: the Bazoulé pond and the Bangr-Weogo urban park.

The Bazoulé is a village in the rural commune of Tanghin-Dassouri, Kadiogo province in the Centre region. The village of Bazoulé has a pond populated by sacred crocodiles, which makes it of great national tourist interest. The pond, located in the center of the village, is a natural splay that covers an area of over three hectares. It is supplied with water by three marigots whose sources are in the surrounding villages. Renovation work was undertaken in May 2017 to increase its capacity. In economic terms, agriculture is the main activity of the local population. The dwellings are widely scattered around the waterhole, which is located in the center of the village

The Bangr-Weoogo Urban Park (UPBW) is located in the heart of the city of Ouagadougou. It is a natural forest of over 265 hectares (Koadima and Sarr, 2010). It is located downstream of Ouagadougou's reservoirs 1, 2 and 3. Together with these reservoirs, Bangr-Weoogo Park constitutes a complex designated as a Ramsar site on 2 February 2019 (Ramsar, 2019). The park has a wide variety of plants and animals and is considered a sacred space, for which reason the Mossi emperor performs certain rituals in the park. It is a very important site for the capital because of the important biodiversity found there.

Materials and methods

Fecal samples (30 and 22 respectively at the Bazoulé pond and the Bangr Weogo urban park) were collected in the vicinity of the Bazoulé water body and the Bangr Weogo urban park in Ouagadougou in February-March 2021. The crocodiles should have been observed defecating and samples taken from the faecal piles of individual animals. Due to the "sacredness" of the animal at the study sites, we were not allowed to make the observations. The faecal samples were therefore collected randomly. Samples were stored on ice for < 24 h before fecal eggs count were performed.

To reduce the risk of false-negative results, we used two techniques to detect parasite eggs, cysts, and larvae in samples: the spontaneous sedimentation method (Hoffman, Pons et al. 1934) and the spontaneous flotation method (Willis 1921). The spontaneous sedimentation method was performed by diluting collected faeces in distilled water and subjecting the sample to sedimentation over a period of 24 h. Samples were then stained with lugol and analysed using a light microscope. For the spontaneous flotation method, samples were processed with a saturated solution of NaCl and transferred to a Borrel bottle, on top of which a slide was placed. After 5 min, slides were removed from the bottle and the material adhering to the slide was stained with lugol and analysed under a light microscope.

We identified parasites on the basis of egg or cyst shape, size, colour and contents. We used an ocular micrometre fitted to a compound microscope to take measurements of eggs, and representatives were photographed.

Measures of parasitism were evaluated according to Bush et al. [1997]. Richness refers to the number of parasite species detected in a host or group. Prevalence refers to the number of hosts infected with a specific parasite species divided by the number of hosts examined.

Fecal egg counts

For fecal egg counts McMaster technique (special modification of the McMaster method—MAFF, 1986) were performed. Flotation solutions were added up to 6 ml, the contents of the tube thoroughly mixed and 1.0 ml was then taken up by pipette to load the two cells of the McMaster slide (Weber Scientific International, England; volume = 1.0 ml). Slides were allowed to stand for 10 min before reading both cells. One egg seen is equivalent to 10 eggs per gram of faeces (analytic sensitivity = 10 EPG).

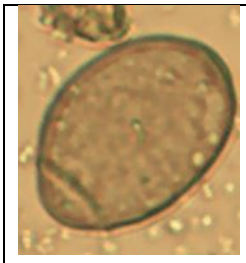
Results and discussion

Following the inventory of gastrointestinal parasites of crocodiles at our sites, no protozoan species were encountered. Crocodiles of Bazoulé and Bangr Weogo urban park of Burkina Faso were infected with gastrointestinal parasites. The global prevalence of infection was 36.53% (19/52). Seven species of helminthes were identified, belonging to six families. These families found infected the examined crocodiles faeces collected included cestodes (21.05%) (Anoplocephalidae, Taeniididea), nematodes (26.31%) (Ascarididae) and trematodes (42.10%) (Fasciololidae, Dicrocoeliidae and Heterophyidae) **(Table I)**. Images of representative eggs are presented in **table II.** Total intensities of infection ranged from 10-470 worms eggs per infected host.

Table I: **summary table of the types of parasites collected from crocodiles in Bazoulé and Bangr-weoogo urban** park

	Families	**Genus**
Trematodes	Fasciololidae,	Fasciola
	Dicrocoeliidae	Dicrocelium
	Heterophyida	Metagonimus
Cestodes	Anoplocephalidae,	Anoplocephala
	Taeniididea	Progromotaenias
Nematodes	Ascarididae	Ascaris
		Dujardinascaris

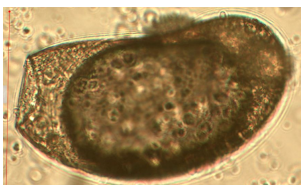
Table II: Images of representative eggs of parasites collected from Bazoulé and urban park Bangr-weoogo crocodiles faeces

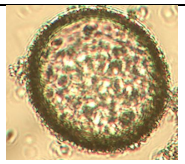


Fasciololidae

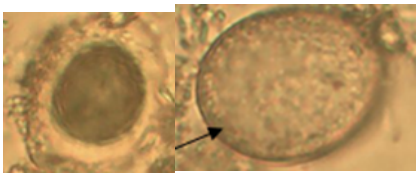


Dicrocoeliidae

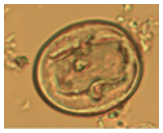




Ascarididae



Anoplocephalidae



The parasitic fauna of the crocodiles of Bazoulé and Bangr-weogo is dominated by trematodes, which in most cases are species with zoonotic potential. This (although partial) inventory indicates the existence of real zoonotic risks associated with human-crocodile interactions in the context of Burkina Faso where this animal is sacred in most of the water bodies it colonises throughout the country. In addition, it is generally believed that parasites reduce the appetite of the host, which has an impact on its physical condition, development and ultimately its survival (Opara, Osuji et al. 2010; Debeffe, Mcloughlin et al. 2016). Controlling the endoparasitic fauna of crocodiles in Burkina is crucial for their management and conservation on the one hand. Awareness of crocodile-borne zoonotic parasitoses is important to promote the control, prevention and surveillance of these neglected diseases on the other hand.

Limitations and perspectives of the study

As mentioned above, due to the "sacredness" of the crocodile in the study sites, we were not able to observe and collect faeces from defecating crocodiles. This did not allow us to establish a correlation between parasitism and the morphometric parameters of the animal and to study the impact of this parasitism on its development. To this end, we are currently working with administrative and customary authorities to close this gap.

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