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General survey on metazoan parasites infecting *Oreochromis niloticus* L. (Teleostei, Cichlidae) from two different fish ponds systems in southern Benin

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Abstract
The present study provides an outset of information on parasites infection in *Oreochromis niloticus* from fish farm and a tributary of the Ouémé River in the Benin southern region. The work was carried out between August and December 2015. A total of 171 specimens of different sizes and body weight were examined for the occurrence of external and internal parasites. The recorded fauna was composed of *Monogenea*, Digenea and Copepods for ectoparasites and Myxosporea, Cestoda, Nematoda and Acanthocephalan for endoparasites. The general prevalence was of 42.69%. The prevalence of females reached its maximum value of 53.85% whereas the highest prevalence of males was found to be still to 39.47%. Cestoda, *Monogenea*, Digenea and Nematoda revealed very low abundance while the highest is recorded with Cestodes. There was a significant difference (χ^2 = 71.627, df = 9, P <0.005) according to the weight of fish between the two sample sites.

Keywords: *Oreochromis niloticus*, metazoan parasites, prevalence, Benin

Introduction

Fish farming is rapidly expanding by intensive promotion of fish culture following the progressive dwindling of wild stocks [1]. In Benin, fish production estimated at 36, 5285 tons in 2013 has increased to 46, 1608 tons in 2017 with a reserve ratio estimated at 44.73% due to fish production for population apparent needs in halieutic products [2]. In order to fill the gap between the natural fish production and the estimated needs of the population for halieutic protein, most of fish farmers applied siluroid fishes [1, 3] supplying Tilapia species that are still used as worldwide oldest common candidates for fish culture.

Tilapia are mainly freshwater fish inhabiting shallow streams, ponds, rivers and lakes, and less commonly in brackish water [4]. Among the subfamily Tilapinae, the Nile tilapia specie *Oreochromis niloticus* Linnaeus, 1766 was of special economic importance. This specie supported the most profitable business for fish farmers and presented an alternative to feed fishing, production or swine-consorted [5] reducing poverty [6]. However, due to harsh parasitism, fish culture will never lead to a sustainable aquaculture development [7-8] unless the production is supported by exceptional management strategies. According to Goselle *et al*. [9], parasites are more common and diversified in the wild culture than farms, ponds and hatcheries and their presence could induce little apparent damages on fish [10]. Then parasitic infections incurring in farms could be devastating with serious socioeconomic, ecological and welfare consequence [11] strengthened by frequent water deterioration providing ideal conditions for parasites multiplication, particularly for species with direct cycle [12-13]).

Several authors have performed studies on parasite fauna of *Oreochromis niloticus* [12, 14-19]. A preliminary study in Benin was set to improve knowledge on the parasite fauna of *O. niloticus* from fish farms only. The present one was designed to provide an insight on the occurrence and the comparison of parasites from cultivated *O. niloticus* and those from wild waters.

Materials and Methods

Two localities (L1 and L2) where do fish provide were selected due to their environmental status. L1 (Hêtin Sota) is a natural source of continental water in the main flow of the Ouémé river and L2 (Ouando) as farm system set upon the town of Porto-Novo in the department of

Ouémé (Figure 1). Samplings of *O. niloticus* composed of 64 from the natural dam (L1) and 107 from the pond (L2) were collected from August to December 2015. Fish were purchased and brought alive to the laboratory at University of Abomey-Calavi. *O. niloticus* was identified as described by Paugy *et al.* [20]. Fish body weight and standard length were recorded. Macroscopic examination under the low power stereomicroscope was performed for detection of any cysts or ectoparasites. After dissection, sex of fish species was determined observing the gonads at nude eye or in microscope. Then, the gut and other visceral organs were removed and placed in saline solution. They were examined in order to search for metazoan parasite under low-power stereomicroscope. Parasites were magnified and identified to different levels using available keys. The common epidemiologic parameters prevalence, mean abundance and intensity were calculated in order to explain the extent of the parasite population in the hosts [21]. According to their prevalence, parasite were considered dominant (D), satellite (S) and rare (R) respectively, when P>50 %,10<P<50 % and P<10 %.Statistical analysis of data was performed by the means of chi-square test ($\chi 2$) to assess the variability between the infection of males and females in the host population.

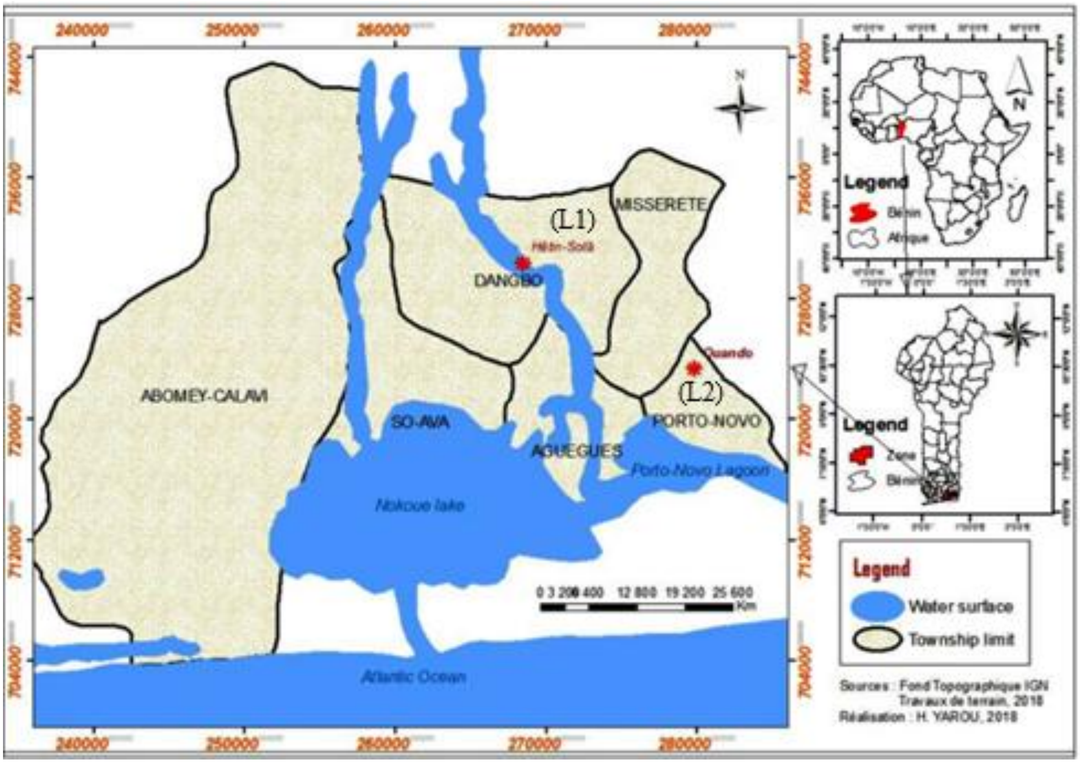

Fig 1: The sampling zone (L1 and L2) in the southern region of Benin (Africa).

3. Results

In total, a prevalence of 42.69% was recorded. In L1, 29 specimens were infected (P = 45.31%) whereas 31 specimens from L2 were infected (P = 28.97%) as shown in Table 1. According to sex, 28.16% and 39.47% of male's vs 30.55% and 53.85% of females were infected in L1 and L2, respectively (Table 1). The recorded fauna was composed of three groups of ectoparasites (monogena, digenea and copepods) and four groups of endoparasites (myxosporea, cestoda, nematoda and acanthocephala) isolated from eye, gills, intestine, kidney and liver (Table 2). The highest prevalence (7.81%) was recorded for monogena, digena and nematoda with a mean abundance varying from 0.1 to 0.2 (Table 3). Cestode infected little fish in L2 and exhibited the highest mean abundance (9.375). For copepoda, prevalence as well as abundance and mean intensity were the lowest (Table 3). All the parasite have a rare distribution (Table 3). Fish with length from 10 to 15 cm were less infected in L1 than in L2. An equal prevalence was registered for fish in 15 to 20 cm range in the two localities (fig. 2). Fish from L2 were more infected than those providing from L1 whatever the class of weight (χ^2 = 71.627, df = 9, P <0.05).

Table 1: Prevalence of infestation according to the sex of *O. niloticus* in L1 and L2

Studied Areas	Total fish examined	Males		Females		Total infected (P%)
		Examined	Infected P (%)	Examined	Infected (P (%)	
L1	64	38	15 (39.47)	26	14 (53.85)	29 (45.31)
L2	107	71	20 (28.17)	36	11 (30.55)	31 (28.97)
Total	171	109	35 (32.11)	62	25 (40.32)	60 (35.09)

P = prevalence (%)

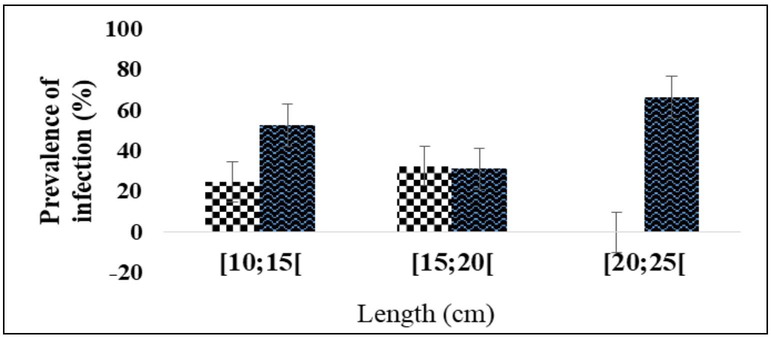

Fig 2: Prevalence of infection according to the length of *Oreochromis niloticus* in L2 (bar-draughtboard) and L1 (filled bars undulations).

Table 2: Parasite richness in *Oreochromis niloticus* in L1 and L2.

Taxa	Species or family	Infected organs	Study areas
Myxosporidia	*Myxobolus elongatus*	Kidney, Liver	L1, L2
Monogena	*Cichlidogyrus* sp.	Gills	L1, L2
	Onchobdella voltensis	Gills	L1, L2
Digena	*Clinostomum* sp.	Intestine, Eye	L1, L2
Cestoda	Gryporynchidae	Intestine	L1
Nematoda	*Spirocamallanus spiralis*	Intestine	L1, L2
Acanthocephala	*Acanthogyrus tilapiae*	Intestine	L1, L2
Copepoda	*Ergasilus* sp.	Gills	L1

4. Discussion

The susceptibility of fishes to infestation with parasites differs and depends on various factors, including morphology, physiology, immunology and diet of the host. The study on the parasite prevalence of *O. niloticus* in the two ecosystems revealed an overall prevalence of 42.69% indicating that less than one second of the sampled population being infested.

Helminthes parasites were the most recorded in this study confirming the works of several authors worldwide [22-25]). That is contrary to reports from Uganda where it was recorded less helminthes [12]. The trend of the results obtained during this study should be dependent upon the low number of fishes examined from the river [26]. It's yet agreed other authors who asserted that parasitism was much more common and diversified in the wild fish populations than in the farms or ponds [27]. The disparity in sex infection rates was similar to Tossavi *et al*. [28] who studied *Henneguya* sp. infection in *Clarias gariepinus* [29-30] reported significant differences between host sexes regarding the prevalence of infection, in disagreement [25, 31]. However, there are inconsistent explanations in literature regarding the relationship between sex and prevalence, some indicating positive correlation and others showing the converse [32]. Nonetheless, Emere [33] attested it to differential feeding either by quantity or quality of food eaten. It's also admitted that due to the physiological state of the female, most gravid females could have reduced resistance to infection by parasites [34].

The recorded fauna is composed of ectoparasites and endoparasites. The composition of the endoparasite fauna of a host is dependent upon the host's feeding and other habits as well as host-specificity and distribution of the parasite [35-36]). Like Usip *et al*. [37], the present work suggested that eyes, kidney and liver were infected on *O. niloticus* whereas Akoll *et al*. [12] recorded parasites in gills, body, intertegument and intestine only. The difference could be due to the presence of the myxozoan parasite recorded in liver and kidney together. It means that parasite distribution was not due to the long times do fishes in water. In intensive farming system, problems are regularly caused by quite frequent protozoan and metazoan [38-39]).Several authors have recorded protozoa parasites from Tilapia [40-41]. According to Basson and Van as [42], *Trichodina compacta* is common in the skin and gills of several freshwater fish families from Africa, Taiwan and Philippines with a particular preferendum in Cichlid. Asely *et al*. [43] suggested that *T. compacta* could be observed whatever its life stage. Its absence during this study could depend on the unfavourable development of organic matter [44-45]). Monogena are the main parasite infecting cultured tilapia in Benin (personal observation). There were no difference between abundance or mean intensity whatever the locality. Anyway, this could be due to the balance between the host immune the system of the hosts and the infectious performance of the parasite [46] supported by a non-alteration of the equilibrium [47-48].

Table 3: Prevalence, abundance and mean intensity of parasites in *Oreochromis niloticus* and parasite classification according to Bush *et al*. 1997.

Parameters \ Species		*Myxobolus elongatus*	*Cichlido-gyrus* sp.	*Onchobdella voltensis*	*Clinostomum* sp.	Gryporyn-chidae	*Spirocamal lanus spiralis*	*Acanthogyrus tilapiae*	*Ergasilus* sp.
Prevalence	L1	3.73	2.80	3.73	4.67	0	6.54	6.54	0.93
		R	R	R	R	R	R	R	R
	L2	4.68	7.81	7.81	7.81	3.125	7.81	4.68	1.56
		R	R	R	R	R	R	R	R
Abundance	L1	-	0.074	0.084	0.065	0	0.084	0.074	0.0093
	L2	-	0.203	0.25	0.109	0.093	0.203	0.093	0.015
Mean intensity	L1	-	2.66	2.25	1.4	0	1.28	1.14	1
	L2	-	2.6	3.2	1.4	3	2.6	2	1

R: rare specie

Conclusion

The results presented herein this paper provide a new comment on the population of parasites pledged on this considered. The evident heterogeneity abundance, community composition, and diversity indices of the metazoan fauna in the two systems is not mainly demonstrated. However, all the recorded species provided from the natural pond in spite of the low number of examined fish and prevalence and abundance are also found slightly elevated. The total prevalence could not rather forecast on parasite devastating infection in the sampling area. Most biosecurity factors like inadmissible sources of fingerlings, silted ponds reduce, lake of proper cleaning and disinfecting of fishing nets could increase the risk of fish parasitism.

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