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Cutaneous and Gastrointestinal Helminth Parasites of the Fish *Synodontis schall* and *Synodontis nigrita* (Siluriformes: Mochokidae) from the Lower Ouémé Valley in South Benin

[1]Jacques Dougnon, [2,3]Elie Montchowui, [4]Florian Dadjo Daga,
[1]Jédirfort Houessionon, [3]Philippe Laléyé and [5]Nestor Sakiti
[1]Departement de Production et Santé Animales, Ecole Polytechnique d'Abomey-Calavi,
Université d'Abomey-Calavi, 01BP 2009 Cotonou, Republique du Benin
[2]Ecole Nationale Supérieure des Sciences et Techniques Agronomiques de Ketou,
Université d'Abomey-Calavi, BP 95 Ketou, République du Benin
[3]Laboratory of Hydrobiology and Aquaculture, Faculty of Agricultural Science,
Universite of Abomey-Calavi, 01BP 526 Cotonou, Republic of Benin
[4]Département de Productions Animales, Faculté des Sciences Agronomiques,
[5]Departement de Zoologie et Genetiqué, Faculté des Sciences et Techniques,
Universite d'Abomey-Calavi, 01BP 526 Cotonou, Republique du Benin

Abstract: Since, approximately 2 decades, there has been a regression of fish captures in Benin and particularly in the Basin of Ouémé river. A high parasitic infestation which would affect negatively the dynamics of the halieutic population, would be one of the probable causes of this regression. The present study aims to inventory helminth parasites in *Synodontis schall* and *Synodontis nigrita* from the lower Ouémé valley in South Benin and to estimate their prevalence. A sample of 75 specimens of the 2 fish species was examined at the laboratory between September and October, 2011. The results revealed high parasitic prevalence in the two species: 82.14 and 78.72%, respectively. Six *helminth* genus were identified of which one digenean trematode (*Clinostomum* sp.), three nematodes (*Citharinella petterae*, *Procamallanus laeviconchus*, *Synodontisia thelastomoides*) and two cestodes *Stoeksia pujehuni* and *Lytocestus* sp. Of the three parasites groups, nematodes are most abundant in both Mochokidae examined; they are 66.53 and 90.58% of parasites counted, respectively in *S. schall* and *S. nigrita*. *Synodontisia thelastomoides* has the highest prevalence: 46.43% in *Synodontis schall* and 42.55% in *Synodontis nigrita*.

Key words: Prevalence, helminth, parasite, *Synodontis schall, Synodontis nigrita*, lower Ouémé valley, Benin

INTRODUCTION

Synodontis schall and *Synodontis nigrita* are two catfishes species which, by their abundance in the lower Ouémé valley, contribute significantly to subsistence fishing (Laléyé *et al*., 2004; Laléyé, 2006). They breed annually in flooded plains when the river is in spate (Laléyé, 2006). In Benin, catfishes are very appreciated for food (Laléyé *et al.,* 2004). They are the second most exploited fish group by artisanal fishing after Tilapias in Benin.

Since, approximately 2 decades, there has been a regression of fish captures in Beninese rivers and particularly in the basin of Ouémé river (Laléyé *et al*., 2007; Montchowui *et al*., 2008). Overexploitation of halieutic resources by the use of prohibited fishnets, river's pollution and the damage of aquatic environments by deforestation and hydro-agricultural substructures are the principal causes of this regression but bacteriological and/or parasitic diseases can be also considered as secondary cause.

Among diseases which affect fishes in natural environment, parasitic occur mostly. Parasitic diseases can affect growth, reproduction and other elements of the dynamics of natural host populations (Hudson and Dobson, 1989; Begon *et al*., 1992; Gbankoto *et al*., 1999, 2003; Simkova *et al*., 2001) but moreover they can sometimes lead to public health problems by means of zoonoses (Collier and Burk, 2002). Researches must thus be done in order to better control the parasitic diseases in

Corresponig Author: Elie Montchowui, Laboratory of Hydrobiology and Aquaculture, Faculty of Agricultural Science, Universite of Abomey-Calavi, 01BP 526 Cotonou, Republic of Benin

aquatic populations. In Benin, few surveys has been carried out to list the parasitic diseases of catfishes in the aim to study their effect on various species of this fish group. Within this context, parasite inventory of fishes provides the basis for extensive researches on the system parasite-host. The present study relates to cutaneous and gastro-intestinal helminths of two catfishes belonging to the family of Mochokidae, *Synodontis schall* and *Synodontis nigrita* in the lower Ouémé valley in South Benin. Researchers aim by this study to widen knowledge about helminth parasites in Mochokidae of Benin.

MATERIALS AND METHODS

Study area: The present study was carried out in the lower Ouémé valley (between 10°00' and 6°30' N) in Benin. The Ouémé river, which length is 510 km, takes its source in the mounts of Taneka and has two principal tributaries, Okpara (200 km) and Zou (150 km) rivers. Ouémé river crosses several agro-ecological zones and feeds downstream by a deltaic zone, the complex lagoon formed by the Lake Nokoue and the lagoon of Porto-Novo. The catchment area exceeds 50000 km^2. Two different parts are distinguished in the basin: Higher and lower Ouémé.

The Ouémé river, while penetrating in the coastal sedimentary basin by the North-East of the plate of Zangnanado, receives its principal tributary Zou in latitudes of Pobé then hug the plateau of Pobé Porto-Novo before being thrown in the lagoon of Porto-Novo. The zone thus crossed constitutes the delta of Ouémé. Its relief allows the spreading out of water during swelling because it has a gentle slope.

Ouémé river's delta has the shape of an elongated triangle and measures 90 km from North to South. The lagoon of Porto-Novo is its southernmost part. The vast deltaic plain is limited by the swamps of the So river in the West and by the plateau of Pobé-Porto-Novo in the East. However, the real outlines of the delta are not very precise, its limits varies enormously with the swelling's importance. Its surface area varies according to the moment when the observations are made. The delta of Ouémé river is subdivided in three parts:

- The high delta, constituting its Northern part is an opened corridor in the argillaceous formations of the Cretaceous and the Eocene extending between 20-30 km. It extends until the limit from Bonou where the middle delta starts
- The middle delta is approximately a 50 km long plain which extends from Bonou to Azowlissé after passing Adjohoun. The width is relatively uniform in this zone where it hardly exceeds 10 km. The riverbed is sandy, the water is shallow in dry season and the banks are rather high. The study area, the village of Agonlin-Lowe is located in this part of delta
- The low delta begins from the downstream of Azowlisse where the valley widens abruptly up to 20 km and finishes with the Southern frontage where the river is thrown in the lagoon of Porto-Novo. There, the river is muddy, the water is deep even in dry season and the banks are low. The plain is easily flooded, low and remains marshy all the year. The middle delta and the low delta constitute the lower Ouémé valley (Fig. 1)

Fish sampling: A total of 75 fishes including 28 *S. schall* of size between 56 and 142 mm (SL) and 47 *S. nigrita* of size between 82 and 178 mm (SL) were examined between September and October, 2011. Fishes were collected at the fishermen using bow nets and gillnets. Fishermen set nets of various meshes in the evening at 16 o'clock and they collect caught fishes the next morning between 7 and 10 o'clock. Bow nets were posed in flood zones during the swelling but they were controlled each day by fishermen. Fresh fishes were brought to the laboratory for data collection.

Data collection at the laboratory: Collected fishes were brought to the laboratory where they were identified in species level, labelled, weighted with an electronic balance (trademark Kern of precision 0.1 g) and measured with an ichtyometer (standard and total length). A macroscopic observation of the skin was made with the eye, looking for any suspect element (cysts especially). Suspect elements, when observed, were taken and laid out between slide and cover glass, in a water drop, to be observed with a binocular magnifier and/or a photonic microscope. The fish digestive tract was entirely extracted and observed with a binocular magnifying glass from esophagus to the rectum. Identified helminthes were observed with photonic microscope. For parasites taxonomy, research of Paperna (1982) and Kabré were served as references. Samples of each parasite species were fixed in alcohol 70%.

Expression of the results and data analyzes: Parasitic prevalence was calculated for each fish species, each parasite species and the parasite groups. Parasitic numerical abundance was noticed for each fish species, each parasite species and for the parasite groups.

In order to establish a correlation between the size (standard length) of fish and the prevalence, fishes were regrouped by size (T_1:50-99 mm, T_2:100-149 and T_3:150-200 mm). No *S. schall* specimen was classified in the class T_3. Statistical test of χ^2 or chi-square was used in order to test the effect of size on prevalence; the variable χ^2 or chi-square was calculated according to the equation:

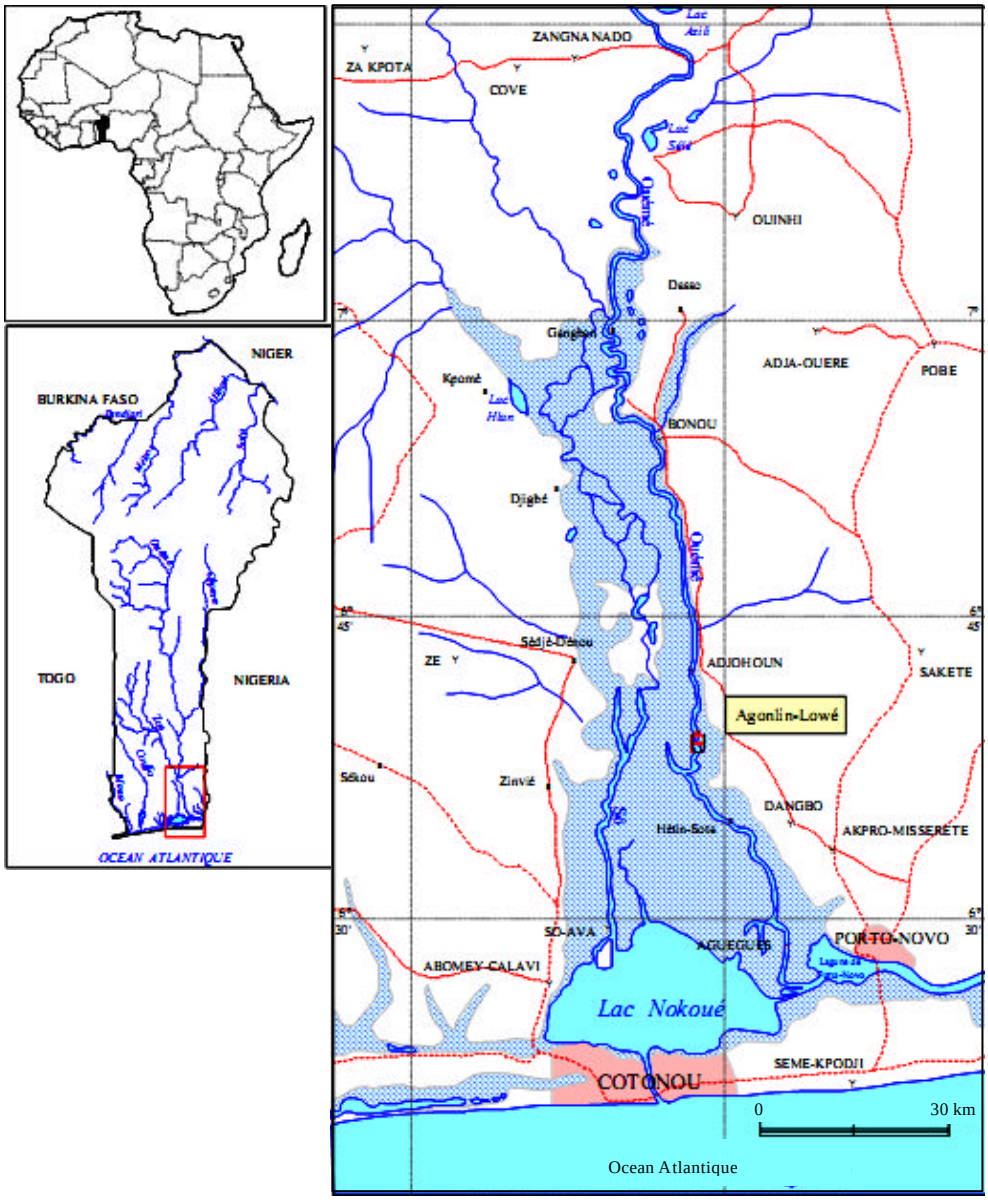

Fig. 1: Map of study area

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

Where:
O_i = Actual values
E_i = Theoretical or awaited values

This calculated variable was then compared with a theoretical variable $\chi^2_{theoretical}$, determined using a χ^2 or chi-square table.

RESULTS AND DISCUSSION

Diversity of the helminthes: A total of 6 species of helminths belonging to four families (Clinostomidae, Lytocestidae, Camallanidae, Pharyngonidae) and six genus were identified during this survey. Clinostomidae are represented by the genus *Clinostomum*; genus *Citharinella* and *Synodontisia* represent the family of Pharyngonidae and the genus *Procamallanus* represents Camallanidae while Lytocestidae are represented by genus *Stoeksia* and *Lytocestus*.

Of six helminth, species observed, one was a trematode (*Clinostomum* sp.), two were cestodes (*Stoeksia pujehuni, Lytocestus* sp.) and three were nematodes (*Procamallanus laeviconchus*, *Cithariniella petterae*, *Synodontisia thelastomoides*). No acanthocephalan was recovered in examined fishes.

Clinostomum sp. occurred exclusively in skin where they are either free or encysted; cestodes were found only in the intestine while nematodes are parasites of the stomach and intestine. In two fish species, *P. laeviconchus* were found only in stomach. No parasites were recovered in esophagus.

Parasitic prevalence: The prevalence of parasitic infestation is 82.1% in *S. schall* and 78.8% in *S. nigrita* (Table 1). Collected data (Table 2) show that *Synodontisia thelastomoides* is the most prevalent specie (46.43 in *S. schall* and 42.6% in *S. nigrita*) while *Lytocestus* sp. is the least prevalent (3.57 and 6.4% in *S. schall* and *S. nigrita*). In S. *schall,* parasitic prevalence is, respectively 67.9, 32.1 and 14.3% for nematodes, trematodes and cestodes while it is 66, 23.4 and 25.5% for *S. nigrita* (Table 3).

Table 1: Parasitic prevalence in fish specie

Species	Number examined	Number infested	Percentage of infection
S. schall	28	23	82.2
S. nigrita	47	37	78.7

Table 2: Parasitic prevalence of parasites species

Parasites	Species	Host	Infested/ examined	Percentage of infection
Trematode	*Clinostomum*	*S. schall*	9/28.0	32.2
		S. nigrita	11/47.0	23.4
Cestodes	*Lytocestus*	*S. schall*	1/28.0	3.6
		S. nigrita	3/47.0	6.4
	S. pujehuni	*S. schall*	3/28.0	10.7
		S. nigrita	9/47.0	19.2
Nematodes	*P. laeviconchus*	*S. schall*	9/28.0	32.1
		S. nigrita	14/47.0	29.8
	C. petterae	*S. schall*	10/28.0	35.7
		S. nigrita	17/47.0	36.2
	S. thelastomoides	*S. schall*	13/28.0	46.4
		S. nigrita	20/47.0	42.6

Table 3: Parasitic prevalence in parasites class

Host	Species	Infested/ examined	Percentage of infection
Nematodes	*S. schall*	19/28	67.9
	S. nigrita	31/47	66.0
Trematode	*S. schall*	9/28	32.1
	S. nigrita	11/47	23.4
Cestodes	*S. schall*	4/28	14.3
	S. nigrita	12/47	25.5

Parasitic numerical abundance: A total of 493 helminth were collected from the 23 examined specimens of *S. schall* and 839 in the 37 infested specimens of *S. nigrita*. *Cithariniella petterae* is the parasite for which the two examined fish species have highest loads, 40.6 and 42.2% of helminth, respectively in *S. schall* and *S. nigrita* (Table 4). With regard to the parasites taxonomic classes, nematodes are more numerous, representing 66.5 and 90.6% of worms recovered respectively from *S.schall* and *S.nigrita*, while cestodes are only 1.2 and 2.7% of parasites in *S. schall* and *S. nigrita* (Table 5). Mixed infestation with the six kinds of parasites has been observed on only one fish specimen but often, hosts were infested by two or three various helminth parasites species.

Prevalence within host size: Table 6 shows the correlation of the helminth infestation with the standard length of *S. schall* and *S. nigrita*. In *S. schall*, groups T_1 and T_2 showed, respectively 73.3 and 92.3% of infestation; group T_3 did not contain any specimen of *S. schall*. The parasitic prevalence does not vary significantly ($\chi^2 = 1.7$, df = 1, NS) according to *S. schall*'s standard length. In *S. nigrita*, parasitic prevalence is 50, 86.67 and 100%, respectively for T_1, T_2 and T_3 and they differ significantly with respect to the size ($\chi^2 = 8.39$, df = 2, $p<0.05$). Even if it seems that bigger fishes are more infested, there is no significant difference between the size group T_2 and T_3 ($\chi^2 = 0.75$, df = 1, NS).

Most of studies (Sakiti *et al*., 1991; Gbankoto *et al*., 1999, 2001, 2003) concerning parasites of fresh and brackish water fishes of Benin were devoted to Tilapias, the first group exploited by artisanal fishing. They often relate to Myxosporidians and Microsporidians. No survey has been devoted to the parasites of Beninese river catfishes in spite of their abundance and their economic function. This preliminary study on the helminth parasites of *Synodontis schall* and *Synodontis nigrita* is a first study carried out on the parasites of Beninese catfishes.

During this study, six species of helminth parasites belonging to four families and six genuses have been collected. These worms are trematodes, nematodes and cestodes.

Many researchers report the presence of metacercariae form of *Clinostomum* sp., in West African Cichlids. Ukoli (1965) and Olurin and Somorin (2006)

Table 4: Numeric abundance of parasites species

Species	Numeric abundance	*Clinostomum* sp.	*Lytocestus* sp.	*S. pujehuni*	*P. laeviconchus*	*C. petterae*	*S. thelastomoides*	Total
S. schall	Number	159.0	1.0	5.0	37.0	200.0	91.0	493
	Percentage	32.3	0.2	1.0	7.5	40.6	18.5	100
S. nigrita	Number	56.0	5.0	18.0	184.0	354.0	222.0	839
	Percentage	6.7	0.6	2.2	21.9	42.2	26.5	100

which either by encysteding in the flesh or free on the gills in *Oreochromis niloticus*, *Tilapia zillii* and *Sarotherodon galilaeus* in Burkina-Faso. Siluriformes fishes infestated by *Clinostomum* sp., are sporadic. However, the results confirmed those of Onyedineke *et al.* (2009), who have observed in Nigeria the infestation of a Mochokids, *Synodontis eupterus* by *Clinostomum* sp. During this survey, no clinostomidae was found in the digestive tract. It is reported that when a man eats poorly cooked fish and infested by Clinostomum, there is a risk of laryngopharyngitis (Kabata, 1985).

Stoeksia pujehuni has also been found in *S. schall* and *S. nigrita*. Kabré has discovered it also but only in *S. schall* with a prevalence of 3.52%. During this survey, the prevalence are 10.7 and 19.2% in *S. schall* and *S. nigrita*, respectively.

Several parasites belonging to the genus *Lytocestus* have been observed during other surveys on parasites of freshwater African fishes. However, infestations of these parasites in Synodontis were rarely observed. Baylis (1928) and Mahon (1954) reported, respectively the infestations of *Lytocestoides tanganiyikae* in *Alestes* sp., in Tanzania and of immature forms of *Lytocestoides* sp., in *Parectodus* sp., in Congo. Khalil (1973) has observed *Lytocestus puylaerti* in *Clarias liberiensis* in Sierra Leone; Kabré has reported the presence of *Lytocestus* sp., in the digestive tract of *Clarias anguillaris* in Burkina-Faso. Out of the African continent, infestations by parasites of the genus *Lytocestus* have been observed. *Clarias batrachus* infested by *L. indicus* (Woodland, 1926), *L. longicollis* (Rama Devi, 1973) and *L. birmanicus* and *L. filiformis* (Chakravarty and Tandon, 1988) has been recorded in India. The genus was also found in Burma (Lynsdale, 1956), on the island of Java (Furtado, 1963), in Malaysia (Furtado and Tan, 1973) and in Nepal (Singh, 1975). Kabré reported a prevalence of 19.6% in *Clarias anguillaris*, although during this survey, researchers observed prevalence of 3.6% in *S. schall* and 6.4% in *S. nigrita*.

Table 5: Numeric abundance of parasites classes

Species	Numeric abundance	Trematode	Cestodes	Nematodes	Total
S. schall	Number	159.0	6.0	328.0	493
	Percentage	32.3	1.2	66.5	100
S. nigrita	Number	56.0	23.0	760.0	839
	Percentage	6.7	2.7	90.6	100

Procamallanus laeviconchus is a Pan-African parasite. There are many researchers (Khalil, 1970; Mashego and Saayman, 1981; Chishawa, 1991; Douellou, 1992; Yakubu *et al.*, 2002; Barson and Avenant-Oldewage, 2006; Onyedineke *et al.*, 2009) who reported it in various fish species (*Schilbeidae*, *Mormyridae*, *Clariidae* and *Mochokidae*) in African countries (South Africa, Nigeria, Zimbabwe, Burkina-Faso). Mashego and Saayman (1981) and Barson and Avenant-Oldewage (2006) counted, respectively 23 and 13 worms per infested fish. The present survey establishes a record of 122 worms on one *S. nigrita* specimen. The infestation prevalence of *P. laeviconchus* is 31.2 and 29.79%, respectively in *S. schall* and *S. nigrita*, although Kabré has recorded a prevalence of 26.2% in *S. schall*.

Data on *Pharyngonidae helminths* are very few in West Africa. The genus *Synodontisi* was discovered by Peter *et al.* (1972) in two Mochokidae, *Synodontis sorex* in Senegal and *Synodontis ocellifer* in Chad. Kabré reported *Synodontisia thelastomoides* in *S. schall* in Burkina-Faso with a prevalence of 3.2%. The researchers observed a prevalence of 46.4% in *S. schall* and 42.6% in *S. nigrita*. *Citharinella petterae* has been reported with a prevalence of 3.3% in *S. schall* in Burkina-Faso while the results reveal 35.71 and 36.2% of instation in, respectively *S. schall* and *S. nigrita*. Other species, *Citharinella khalili* was discovered by Peter *et al.* (1972) in other Mochokidae (*Synodontis sorex* in Senegal and *Synodontis gambiensis latifrons* in Tchad). Benin is then included in the distribution surface area of the Pharyngonidae.

The parasitic prevalence in examined two Mochokidae are high (82.2 and 78.7% in, respectively *S. schall* and *S. nigrita*). Almost all observed helminths are intestinal parasites. These two reports could be attributed to the sanitary conditions of the study area, the promiscuity between the river and the living place, people activities on the bank and more the omnivore nature of fishes examined. Highest prevalence has been recorded for Nematodes which are also the parasites for whom fishes have greatest parasitic loads.

When parasites do not induce host's death, the infestation tends to rise with time, leading to a higher prevalence and parasitic load in the oldest fish, i.e., which have greatest size (Lester, 1984). However, the prevalence did not vary significantly with the size in *S. schall*. Thus,

Table 6: Parasitic prevalence in relation with fishes Standard Lenght (SL)

	50-99		100-149		150-199		Total	
SL (mm)	*S. schall*	*S. nigrita*	*S. schall*	*S. nigrita*	*S. schall*	*S. nigrita*	*S. schall*	*S. nigrita*
Examined	15.0	12.0	13.00	30.00	0	5.0	28.00	47.00
Infested	11.0	6.0	12.00	26.00	0	5.0	23.00	37.00
Prevalence	73.3^{a}	50.0$^{a'}$	92.31^{a}	86.66$^{b'}$	0	100.0$^{b'}$	82.14	78.72

Values, of the same line for the same species which are not marked with the same letter are significantly different ($p < 0.05$)

recovered *Clinostomum* sp., in the intestine of tilapias in Nigeria. Coulibaly and Kabré reported their infestation it seems that the size does not have a significant effect on parasitism in the examined specimens of this species which could be the due to the randomization effect of the sampling. On the other hand, percentages of infestation in *S. nigrita* vary significantly with the size. Fishes with biggest size are more infested. The non significant difference between size groups T_2 and T_3 can be due either to the randomness of the sampling or to the mortality induced by a too high infestation of oldest fish which would be slightly represented in our sample.

Surveys conducted by Akinsanya *et al.* (2008), Onyedineke *et al.* (2009) and other researchers reported Mochokidae fishes infestation by other helminths belonging to genuses *Paramphistomum*, *Bucephalus*, *Pomporhynchus*, *Wenyonia* and *Proteocephalus*. None of these genuses has been observed during the observations. That can be explained by the fact that either the specimens of the study sample were not infested by those parasites or the parasites themselves are not living in Beninese rivers.

CONCLUSION

This study reveals a high parasitic infestation of fish by six species helminth parasites. Results obtained are certainly interesting; nevertheless, it remains that other aspects should be deepen in order to understand more the parasitic dynamics within the system fish-parasite.

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