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Gastro-intestinal parasites of *Hyperopisus bebe occidentalis* (gunther, 1866) in river Galma at Dakace Zaria

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Abstract

Parasitic disease is considered among the limiting factors in freshwater fish production. Fish is a cheaper source of animal protein available to the people thus, the need to control parasites that affect their productivity. Three hundred and twenty (320) *Hyperopisus bebe* occidentalis obtained from River Galma at Dakace, Zaria between August, 2016 and February, 2017 were examined for gastro-intestinal helminths using the formal-ether concentration techniques. Results obtained showed that 124 (38.8%) fish examined were infected by the acanthocephalan *Rhadinorhynchus horridus* and no other helminthes were recovered. The worms recovered were mainly from the small and large intestines, with the mid-intestine accounting for the greatest number of parasites with 90.74%. There was a general increase in infestation with increase in size of fish and there was no significant difference between the infections of male and female fish.

Keywords: Gastro-intestinal helminthes; *Rhadinorhynchus horridus; Hyperopisus bebe occidentalis*; Parasites; Fish**.**

1. Introduction

Parasitic disease is considered among the limiting factor in freshwater fish production. Most species of the family mormyridae are numerous and contribute immensely to commercial catch [1]. *Hyperopisus bebe occidentalis*, a member of this family has been chosen for this study. All living things, including fish can become infected with diseases under certain circumstances. Fish have diseases, parasite and abnormalities, both malignant and benign. There is no question that fish die from such disorders, natural enemies other than human and old age [2]. Fish is recognized as a gill breathing exothermic, aquatic vertebrate that possesses fin and skin that is usually covered with scales [3]. Since fish is the cheaper source of animal protein available to the people, we need to control the parasites that affect their productivity. Fish flesh contains the ten essential amino acids which are not found in plant protein in desirable concentration for human. It also contains minerals such as iodine, phosphorus, potassium, copper and vitamins A and D [4]. *Hyperopisus bebe occidentalis* was chosen for this study because it is an important freshwater fish found in most Nigeria freshwaters due to their great adaptability. Fish and aquaculture put together has its economic importance to the community. Uses of fish include; source of food, income, foreign exchange earnings, provision for employment, tools for rural development. Their uses can be hindered by some limiting factors such as invasion by micro-organisms and parasites [5]. Knowledge of fish biology and species composition of different water bodies is necessary to enhance the management of water resources. Therefore, careful study must be made on their natural stocks including their biology and ecology [6]. Like all animals, fish have a full complement of diseases, parasites and abnormalities, both latent and patent [2]. Long term quantitative studies of parasitic infestation cycles in fish populations in addition to ecological environment parameters are important tools in predicting fish production. Fisheries not only need information on the

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role of parasites in fish disease, but also on fish that harbor zoonotic parasites, these data are important in understanding the aspects of the ecology of natural production of fishes.

Wedmeyer and Yasutake [7] pointed out that disease in fish tend to be the end result of an interaction between host susceptibility, pathogen virulence, and environmental factors. Thus, the economic importance of fish parasite and diseases cannot be overemphasized as they could cause mass mortalities, reduced production and diminish the quality of fish products whether for consumption or live sale for sport fisheries.

Aken`Ova [8] pointed out that the parasite and host generate conditions which influence each other. The fish responds to the presence of parasites that affect it. Resistant results in dynamic relationship. The effect of parasite in their host is by the parasites` mechanical action, causing injury by physical pressure by their movement, attachment and biology of system and withdrawal of materials necessary for normal metabolism of the host. They course retardation of growth, through inhibition of host enzymes, parasitic castration and so on.

The major groups of helminth parasites are comprised of Nematoda, Cestoda and Trematoda. The nematodes, *Procamallanus laevionchus and Rhabdochona congolensis*, the cestode, *Polyonchobothrium clariae*, and the trematodes *Allocreadium* spp. and *Heterophyidae* spp. [9]. There is an increasing awareness of the importance of parasitic diseases as one of the major detrimental factors in fish farming [18,19]. Still, in Zaria, there is a scarcity of information on the parasitic status of *Hyperopisus bebe occidentalis.* Therefore, this study sought to determine the prevalence of gastrointestinal helminth parasites in the study area with the view of quantifying the helminthic burden and to evaluate the relationship between infection, the sex, weight and length of *Hyperopisus bebe occidentalis*.

2. Material and methods

2.1. The Study Area

Zaria is located on a plateau at a height of about (11’33N, 7’43E). It has a tropical continental climate which is more pronounced in the dry season lasting up to seven months (October to May). During this period, most stream, ponds, and puddles dry up. Shortly after the return of the rain/wet season, the streams and ponds become alive with a lot of fish [10].

2.2. Sample collection and identification

The fish specimens were randomly purchased live from the local fishermen and transported in a polythene bag containing ice to the Department of Biological Sciences, 400 Level Zoology Laboratory, Ahmadu Bello University, Zaria. Fish were identified as described by [11] and [12], where they were sorted according to different sizes. Identification of the fishes was done based on external features as described by Idodo-Umeh (2003). Lengths and weights of the fishes were measured using a ruler calibrated in centimetre (cm) and digital weighing balance (Electronic Kitchen Scale, QE-KE-4), respectively. The sexes of the fishes were identified by visual examination of the urinogenital system. *Hyperopisus bebe occidentalis* were opened up by a longitudinal ventral cuts from just anterior to the anal opening cutting across the pelvic fins to the first, anterior and posteriorly to expose the viscera. The digestive track was then cut out and placed in a Petri dish containing distilled water. The sections of the digestive tract were slit open to release their contents into the distilled water, under a dissecting microscope. The contents of the stomach were noted. Any parasite found were removed without damage, using a pair of forcep or a Pasteur pipette, and placed in a cavity block containing distilled water for further processing. The sexes of the fish specimens were identified by the shape of the fins. In female, it is straight or concave, while the male are convex [1]; the sex of the fish was confirmed after cutting open the body cavity to identify the testes in the case of male and ovaries in the case of females. Fish were identified as described by [11] and [12].

2.3. Measurement and weighing

The total and standard lengths of the fish were measured using measuring board calibrated in centimeters. The weight was taken using an electric top loading meter balance model PI200N to the nearest gram.

2.4. Preservation of Helminths

Worms recovered from the gut contents were washed in physiological saline and fixed in hot distilled water. Hot, to kill them and then fix them in a life-like form. They were then preserved in 5% formaline in specimen bottles. The bottles were labeled with a piece of paper with the following details in pencil: autopsy number, date of collection, sex of fish, and number of parasite. The labels so prepared were place inside the specimen bottle with the parasites.

2.5. Staining

The preserved parasites were washed in distilled water to remove the fixative then stained for about 24hours in a very weak solution of Mayer's acid haematoxylin in cavity block. The parasites were rinsed with distilled water, de-stained in 0.5% hydrochloric acid, rinsed again in distilled water and neutralized in 0.5% ammonia solution to stop the action of the acid. They were then dehydrated in a graded series of alcohol (30% and 50% with each treatment kept for 30 minutes and at 70% for overnight) and finally in absolute alcohol for 40 minutes. Absolute alcohol was gradually replaced with xylene. The parasites were then left to clear in pure xylene for about 30 minutes. The cavity block was kept covered during processing to avoid rehydration from the atmosphere. The cleared parasites were then mounted on microscope slide in thinned Canada balsam and viewed under microscope.

3. Results

A total of three hundred and twenty (320) *Hyperopisus bebe occidentalis* were examined for helminth parasites. Of these, one hundred and twenty four (124) representing 38.75% were infected with the acanthocephalan *Rhadinnorhynchus horridus*. A total of two hundred and twenty (220) worms were recovered in the large and small intestines. No worm was found in the oesophagus, stomach and rectum (Table 1). These acanthocephalan parasites were mainly restricted to the intestinal region of the gut.

Table 1 Infestation of *Hyperopisus bebe occidentalis* by Rhadinorhynchus horridus according to sites of infection

NHE	NHI%	Oes	stom	SI	LIA	Rect.B	MI+SD
320	124	0	0	216	4	0	6.96+1.74

KEY: NHE= Number of hosts examined, NHI= Number of host infected, Oes= Oesophagus, stom= Stomach, SI= Small intestine, A= adult worm, B=Cystacanth, LI= large intestine, Rect= rectum, and MI= Mean intensity ± standard Deviation.

Relationship between Body Weight of Fish and Intestine with *Rhadinorhynchus horridus*. The weight of fish that fall within the range of 30-80gm had highest prevalence of infection (Table 2). The result shows that there is a negative correlation between body weight of fish and infection with *Rhadinorhynchus horridus*. However, there is no significant correlation since p>0.05.

Table 2 Infestation of *Hyperopisus bebe occidentalis* according to weight

Weight (g)	NHE	NHE (%)	NPR	Range	MI
30-80	184	64	100	1-7	6.24
81-130	64	20	36	1-4	7.2
131-180	16	16	40	1-3	10
181-230	60	12	16	1-4	5.32

(r=-0.84, p=0.159). The result shows that there is a negative correlation. However, there is no significant correlation since p>0.05.
Key: NHE= number of host examined, NHI= Number of hosts infected, NPR= Number of parasites recovered, MI= mean intensity, r= Correlation, and p=probability.

Table 3 Prevalence of Infection of male and female *Hyperopisus bebe occidentalis* according to weight

	NHE		NHE (%)				
Weight range (g)	**M**	**F**	**M**	**F**	**NPR**	**Range**	**MI**
30-80	60	124	16	48	100	4-16	6.4
81-130	20	44	0	24	36	0	7.2
131-180	12	8	12	8	40	6-10	10
181-230	4	44	4	8	16	2-4	5.32

(t= 1.3, P= 0.216). P>0.05, there was no significant correlation between weight of fish and prevalence of infection.
Key: NHE= Number of hosts examined, NHI= number of hosts infected, NPR= Number of parasites recovered, MI= Mean intensity,

t= student t-test, and p= Probability.

Infection in male and female *Hyperopisus bebe occidentalis* in Table 3, shows the degree of acanthocephalan infection in male and female *Hyperopisus bebe occidentalis*. Of the 320 fish examined, 232 were female representing 70% of the total number. About 88 of the 224 female (39.28%) were infected. From the result, 96 of the 320 fish examined were male representing 30%. There was no significant correlation between weight of fish and prevalence of infection.

Prevalence of acanthocephalan Infection along Different Regions of the intestine. The distribution of acanthocephalan parasite along the anterior, middle and posterior regions of the fish intestine is shown in table 1. Most of the fish examined were infected in the mid-intestine with about 90.74%. The large intestine was least infected (Table 4).

Table 4 Prevalence of Infection of male and female *Hyperopisus bebe occidentalis* according to length

Weight range (g)	**NHE**		**NHE (%)**		**NPR**	**Range**	**MI**
(cm)	**M**	**F**	**M**	**F**	**M**	**F**	
16-20	23	9	0	5	7	1-4	1.40
21-25	16	26	4	11	23	1-7	1.53
26-30	0	4	0	0	0	0	0
31-35	6	9	4	4	23	1-6	2.88
36-50	0	8	0	3	3	0-3	0.37

(t=1.4, p=0.182). This result shows that there is no correlation since p>0.05.

Key: NHE= number of host examined, NHI= Number of hosts infected, NPR= Number of parasites recovered, MI= mean intensity, r= Correlation, t= student t-test and p=probability.

4. Discussion

The results of the present study on the helminth parasites of *Hyperopisus bebe occidentalis* with *Rhadinorhynchus horridus* shows a prevalence of 38.8% which is lower compared to the work of [14] who investigated the endo-parasitic helminthes of four mormyrid species (Osteichthyes:Mormyridae) from a West African flood River system and reported the overall prevalence of endo-parasites in the fish host was 41.9%. The prevalence of *R. horridus* was relatively high in *H. bebe bebe* (40.6%) and *G. Petersii* (34.6%), which it parasitized. The prevalence of this research was still found to be lower compared to the work of [13] which stated that acanthocephalan infections of cichlids and mormyrids in River Galma, Zaria, Nigeria and only adult worms where recovered from the mormyrids. Among the mormyrids examined, only *H. bebe occidentalis* was infected; it had a prevalence of infection of 40.5%.

This worm has also been recovered by [14] in the study area. Usually, there is a close food link between the definitive and intermediate hosts of acanthocephalans. The intermediate hosts form part of the food of the definitive host. Petrochenko [5] noted that for all acanthocephalan infections, the definitive hosts are directly infected. The definitive hosts are directly infected by consuming the intermediate hosts. Dissection of *Hyperopisus bebe occidentalis* revealed the presence of potential intermediate hosts of the acanthocephalan (mollusk, crustaceans and insects), with mollusk occurring in the majority.

Rhadinorhynchus horridus was found only in the intestine, mostly confined to the middle region. This high concentration of acanthocephalan infection was found in the middle region of the hosts. It also indicates the site specificity of the hosts. Petrochenko [5] noted that the presence of nutritive substance ready for absorption by the host makes the parasite develop very rapidly. The absence of heavily infected large fish could be due to general death of heavily infected small fish or acquired immunity [16]. Rogers [17] noted that, for the smaller fishes to be infected are not because they have no immunity but that their immunity is weak, and their ability to withstand stress is less.

Matouke *et al.* [14] found the length range of fish were 19.4-31.5 cm and weight range 50-400g, and there was a significant correlation between the length of fish and the prevalence of infection in the mormyrids (represented by *H. bebe occidentalis*) ($P<0.05$) is in agreement with the present study which stated that Weight of *Hyperopisus bebe occidentalis* does not influence the prevalence of infection.

5. Conclusion

Hyperopisus bebe occidentalis in Zaria are infected with the acanthocephalan *Rhadinorhynchus horridus*. Male and female *Hyperopisus bebe occidentalis* are equally susceptible to acanthocephalan infection. Weight of *Hyperopisus bebe occidentalis* does not influence the prevalence of infection.

Recommendations

This study recommend that further work to be done on other mormyrids so as to have an insight into the range of this parasite in Zaria area. And also, the government at all levels should synergize efforts toward sensitizing fish farmers on this parasite, with a view to enhance productivity of fish in the country. This will go a long way to increase the country's Gross Domestic Product (GDP) and it will also create employment for the country's teaming population.

Compliance with ethical standards

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Disclosure of conflict of interest

None.

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