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Research Article

Helminth Parasites of *Bagrus filamentosus* from Lower River Benue, Nigeria

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Abstract
The present study was designed to investigate the possible Helminth parasites of *Bagrus filamentosus* in Lower River, Nigeria. Eighty (80) *Bagrus filamentosus* (39 Males, 41 Females) were evaluated for this study. Examination of the fish species revealed that, they were infected with three helminth parasites species: *Diphillobothrum latum*, *Camalanus* and *Eustrongyllus* species. Of the 80 *Bagrus filamentosus* examined, 17(21.3%) were not infected by any helminthes parasite while 63 (38.7%) were infected and observed to harbour a total number of 163 parasites each belonging to one species of Cestode (*Diphillobothrium latum*) and two species Nematode (*Camalanus* and *Eustrongyllus* species). *Diphillobothrium latum*, 63 (38.7%) was found to be the most abundant species, while *Camalanus* species 39 (23.9%) had the least. Among the body parts examined, stomach and intestine harboured the observed parasites. The results of parasitic prevalence of *Bagrus filamentosus* in relation to Sex also showed that the females had the highest percentage parasite load of 96 (59.51%) while the male recorded the least 67 (41.10%). Percentage infestation followed the same trend as 47.5% for female and 31.25% for male. Fish with smaller body weight haboured more parasites than those with larger body weight while parasitic prevalence was also observed to be high for the studied specie.

Keywords: Helminthes; *Bagrus filamentosus*; Cestode; Nematode.

Introduction

Fish has continued to be the most easily affordable source of animal protein to the average Nigerian family [1]. Nigeria has an estimated 12.5mha of freshwater surface area of lakes, reservoirs and ponds which are capable of producing 521,000 metric tons of fish but have not succeeded in attaining fish food sufficiency [2]. Therefore, improvement and extension of inland fishing and fish culture are becoming quite important in the development program of Nigeria [3]. Due to the importance of fish as one of the major source of obtaining cheap protein, studies on parasitic prevalence and diseases of fish is very important. The propagation of Fish provides a large reservoir of parasitic pathogen common to both cultured and wild fish. Presently, no epidemic has been reported in Nigeria but it is likely that as the culture of fish becomes intensive and more widespread, parasites will be liable to become a menace [4]. Parasites are organisms that live on another organism either permanently or for a part of their lives [5]; they are the most diverse and common pathogens the aquaculturist may likely encounter and parasite diseases are very common in fish all over the world, especially in the tropics [6].

Parasites of fish are of great importance, since they often produce a weakening of the host immune system thereby increasing their susceptibility to secondary infections. This results in the nutritive devaluation of fish and subsequent economic losses [7]. The possibility of disease transmission from fish to humans through fish consumption is a public health concern [8]. The commonest infection are caused by trematodes *Clinostomum* specie., *Euclinostomum* species and nematode *Procamellanus* sp. Earlier workers, [9] and [10] has subscribed to this observation. The negative impact of parasites on host-growth and survival has been demonstrated in several parasite-fish host system both in aquaculture and in natural population [11]. Profound pathological changes associated with piscine parasites cause low growth rhythm considerably, affect the quality of

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the fish and often leads to death of fish resulting in enormous economic losses to the fish industry. Some piscine parasites are transmissible to man and other fish-eating domestic and non-domestic animals [12].

In general, fish parasites have been long neglected because of its inherent difficulty in studying compared to other larger parasites. These parasites may attack fish causing massive destruction of the gill epithelium and skin. Even moderate infection of these organisms on small fish may prove a fatal disease, since the infection may cause the fish to stop feeding [13]. Some parasites are obligate which utilize gills and skin merely as a substrate for attachment. Thus, their pathogenicity is attributed to the mechanical interference with gas exchange activity [14]. Substantial information has been generated on aquaculture-related subjects in Nigeria with the increasing aquaculture activities. An exception is fish diseases. Outbreaks of disease, however, constrain sustainable aquaculture production unless comprehensive management strategies are in place [15]. Preliminary investigations into disease outbreaks in fish farming systems have reported a number of conditions resulting in mortality [16]. Several scientific papers and books have been published in the past on diseases of wild and farmed fish from Africa [9, 17].

Documented information on fish diseases is scanty in Nigeria and work carried out in limited number of water systems. Some of which were in Cross-River estuary by [18], in Kainji lake and associated tributaries of River Niger by [19], in Gwagwalada, Abuja by [20], in Zaria Area by [21,22]. In Lake Chad basin by [23]. In Kano, at Tiga Dam by [24,25]. The Bagridae families are the most caught and sought for fish from lower river Benue. The study was conducted to determine the parasites diversity, their infection intensity and prevalence in *Bagrus filamentosus* from Lower River Benue, Nigeria.

Materials and methods

Study site

The study took place at Wadata in Makurdi, the capital of Benue State, Nigeria, located at longitude 7°43′ N and latitude 8°32′ E (Fig. 1). Makurdi town is divided into the north and south bank by the River Benue. River Benue exists year round though the water volume fluctuates with season. The river overflows its banks during the rainy season (May–October) but decreases drastically in volume leaving tiny island in the middle of the river during the dry season (November–April). The river contains several species of freshwater fishes of different families [26].

Fig. 1. Map of Lower River Benue along Wadata Market, Makurdi, Benue State Nigeria

Sample collection

Eighty (80) live fishes of 80 *Bagrus filamentosus* of different sizes were examined. 10 fish samples of each species were collected forthnightly for the period of 4 months (May-August, 2018) from local fish mongers along the course of River Benue in Wadata market, Makurdi, Benue state. The fishes were identified using the field guide to Nigerian freshwater fishes by [27].

Fish examination and parasite collection

Total and standard lengths of each fish were measured in centimeters (cm) using meter rule, while the weight of each of the fishes were taken in grams (g) using an electronic meter balance. The sexes of the fishes were also determined externally and by dissection to reveal the gonads. The stomach and the intestine of the fish species were dissected and examined. The lining of the gut lumen were scrapped out and placed in saline solution. Two drops of the preparation was placed on slide covered with slips and observed on the HP Laptop using a Zd pix 640 digital microscope for helminthes parasites. The parasites were identified by taking and saving their pictures on the Laptop as observed on the Zd pix 640 digital microscopes, and compared with the pictorial Guide on fish parasites by [28]. All measurements were taken and parasites observed on the binocular microscope were counted and recorded.

Parameters test

Mean intensity= Total no. of parasites in lt/wgt group/No. of fish infected in lt/wgt group, Mean abundance=Total no of parasites in lt/wgt group/No. of fish examined in lt/wgt group, Percentage Parasites =Total no. of parasites /Total parasites X 100, Percentage infestation = Total no. infested/No. of fish examined X 100

Data analysis

Parasite prevalence, mean intensity and mean abundance were determined according to Bush *et al*. [29]. The data obtained was subjected to statistical analysis using SPSS 17.0 software to determine the significance mean difference.

Results and discussions

Results of the live *Bagrus filamentosus* examined are presented in Table 1. Of the 80 *Bagrus filamentosus* examined, 17 (21.3%) were not infected by any helminthes parasite while 63 (38.7%) were infested and were observed to harbour a total number of 163 parasites each belonging to one species of Cestode (*Diphillobothrium sp.*) (Fig. 2) and two species Nematode (*Camalanus* species and *Eustrongyllus* species) (Fig. 3).

Table 1. Distribution, location and number of parasites found in *Bagrus filamentosus* from River Benue

Parasites species	Phyla	Organ infested	No. (%) fish infested	TNP (%)	*MI*	*MA*
Camalanus species	Nematoda	Intestine	17 (24.3%)	39 (23.9%)	2.29	0.49
Eustrongyllus species	Nematoda	Stomach	26 (37.1%)	61 (37.4%)	2.35	0.76
Diphillobothrum latum	Cestoda	Intestine	27 (38.6%)	63 (38.7%)	2.33	0.79

**TNP*- total number of parasite, *MI*- mean intensity, *MA*- mean abundance

Fig. 2. Pictorial view of a Cestode (*Diphilobothrium latum*) recovered from *B. filamentosus*

Fig. 3. Pictorial view of a Nematode (*Eustrongyllus* species) recovered from the stomach of *B. filamentosus*

It was also observed that *Diphillobothrium latum*, 63 (38.7%) was found to be the most abundant species, followed by *Eustrongyllus* species, 61 (37.4%) while *Camalanus* species, 39 (23.9%) had the least. Among the body parts examined, stomach and intestine harboured the observed parasites. It was also observed that intestine had the highest number of parasites 102 (62.58%) while stomach had the least 61 (37.4%). *Eustrongyllus* species, recorded the highest mean intensity (2.35) while *Camalanus* species had the least (2.29). Highest mean abundance was recorded for *Diphillobothrium latum* (0.79) and the least for *Camalanus* species (0.49).

Results of the parasitic prevalence in relation to the size of *Bagrus filamentosus* are shown in Fig. 4. It was observed that length group 24-29.5 had the highest (36.81%), and 18-23.5, had a close value (35.58%) and the least recorded for 12-17.5 (11.04%). Results of parasitic prevalence of *Bagrus filamentosus* in relation to Sex as presented in Table 2 indicated that the females had the highest percentage parasite load of 96 (59.51%) while the male counterparts recorded the least 67 (41.10%). Percentage infestation followed the same trend as 47.5% for female and 31.25% for male.

Table 3 presents the results of weight group distribution of *Bagrus filamentosus*. Weight group 107-137.5 had the highest

percentage parasitic load 62 (38.01%), followed by 45-75.9, 61 (37.42%) and the least of 3 (1.84%) for 169-199.5. The results showed that fishes with smaller body weight haboured more parasites than the larger body weight. Results of the Descriptive Statistics for Total Length (TL), Standard Length (SL), Weight (WGT) and Total Number of Parasites (TNP) on all body parts of *Bagrus filamentosus* from River Benue is presented in Table 4. The results showed that from the total fish sampled, the minimum TL, SL, WGT and TNP were 12.70, 8.10, 45.00, 0.00 respectively while the maximum recorded was 34.90, 30.00, 173.10 and 6.00 respectively. However, mean weight (WGT) had the highest mean value of 94.26±4.17 and the least value recorded for TNP (2.03±0.16).

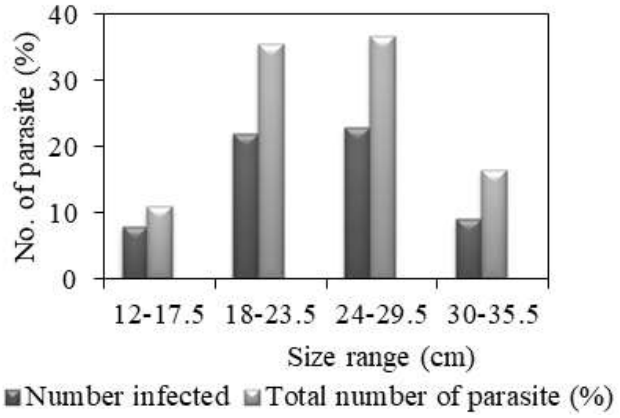

Fig. 4. Parasites distribution by size in *Bagrus filamentosus*

Table 2. Prevalence of parasites in relation to sex of *Bagrus filamentosus* from river Benue

	Sex	
	Male	Female
No. examined	39	41
No. infested with parasites	25	38
% infestation	31.25	47.5
No (%) of parasite	67(41.1)	96(58.9%)

This research reports on the helminthes parasites of *Bagrus filamentous* the commercially captured fish species in river Benue, Makurdi. The survey found a wide spectrum of helminthes parasites in *Bagrus filamentous* distributed throughout the studied area. The parasite diversity indices obtained in the present survey revealed that *Bagrus filamentous* harboured parasites. However, the parasite community and individual numbers did not differ significantly ($p>0.5$). The parasites harboured were tropically and free-living transmitted species that were present in relatively high numbers. The variation in parasite populations in the hosts may reflect habitat and diet of the fish [30, 31].

The differences in prevalence of infection between the juveniles and the adults as related to their length and weight may be due to changes in their diet from weeds, seeds, phytoplanktons and zooplankton to insect larvae, crustacean and worm in both juveniles and adult respectively this was in agreement with [32]. The physio-chemical parameter of the River was suitable for parasites growth and fish survival. The fact that parasite in the fish did not affect the physiological condition despite the favourable condition suggest the fishes may have a high tolerance and/or resistance to parasitic infection [33]. Peak infection was highest in rainy season in August, low in May, this observation agrees with [17] on the seasonal occurrence of parasite. With regard to helminthes parasites, *Bagrus filamentous* and feeds mainly on phytoplankton and macrophytes, although zooplankton and benthic organisms also contribute to their diet [34]. Zooplankton and benthic organisms act as intermediate hosts for several endohelminths, their intake exposes the fish to infections. Nevertheless, the contribution of zooplankton and benthic organisms to the diet of *Bagrus filamentous* is high, thus increasing the intake of the parasites, [35]. They also feed on a wide range of food items including detritus, zooplankton, and insects, all of which act as intermediate hosts for several helminthes [35]. The omnivorous behaviour and resulting continuous intake of infected intermediate hosts led to accumulation of parasite species, culminating in high mean intensities [30]. With regard to host size, the results revealed a shift in parasite composition from a monoxenous-dominated community in young fish to a heteroxenous-dominated community in large-sized fish. The change in parasite composition was attributed to an ontogenetic feeding shift, with a prolonged exposure to intermediate hosts/infectious stages in older (larger) fish [31]. Thus, until the fish is removed from the population through predation or mortality, the parasite accumulates with fish size (age) [36]. Increase in parasites population in final hosts also accumulates due to continuous and prolonged exposure to infected intermediate hosts. Although intraspecific competition can inhibit accumulation [31], this could not be

ascertained during the present study. Parasitic prevalence of infested females was more than males. This is similar to the findings of [31] that reported higher parasitic prevalence and attributed it to the different physiological state of the gravid females'. [26], who reported that gravid females could have had reduced resistance to infection by parasites, and in addition their increased rate of food intake to meet their food requirements for the development of their eggs might have exposed them to more contact with the parasites which subsequently increases their chance of being infested. Furthermore, [37] also reported that females are more susceptible to parasitic infection during breeding season than the male counterpart, this could be due to the difference of the physiological condition of the females especially gravids ones. The basic function of the immune system is clearly reported by [37]. It is to protect an organism against infection in order to minimize the fitness costs of being infected. The high rate of infection in the bigger and female fishes is also attributed to their immune system; this is reported in the findings of [37] who recorded high and decreased fish condition in the period of gonad formation of infection *Cyprinus carpio*.

Table 3. Weight group distribution of *Bagrus filamentosus* from river Benue

	45-75	76-106	107-137	138-168	169-199
No. examined (%)	34 (42.5%)	8 (10.0%)	28 (35.0%)	9 (11.2%)	1 (1.2%)
No. infested	24	8	22	8	1
% infestation	30	10	27.5	4.91	1.25
No. (%) of parasite	61 (37.42%)	18 (11.04%)	62 (38.01%)	18 (11.04%)	3 (1.84%)

Table 4. Descriptive Statistics for Total length (TL), Standard Length (SL), Weight (WGT) and Total Number of Parasites (TNP) in *Bagrus filamentosus* from river Benue

	TL (cm)	SL (cm)	WGT (g)	TNP
Min.	12.70	8.10	45.00	0.00
Max.	34.90	30.00	173.10	6.00
Mean	-	23.6±0.62	94.26±4.17	2.03±0.16

Conclusions

In conclusion, Parasites recovered from *Bagrus filamentosus* were *Diphillobothrum latum* which had the highest followed by *Eustrongyllus* while *Camalanus* recorded the least number in fishes examined. It could be observed that *Bagrus filamentosus* habours high load of different parasites. Although most of the species found during the survey can be prevented or controlled, if not the associated effect may cause adverse environmental impacts. Disease should therefore be prioritized in fish development plans, and alternative parasite control and preventive measures utilizing ecological information should be adopted. Ecological data on the parasites present on fish species are essential. The public also needs to be sensitized and made aware of key fish diseases, parasite transmission pathways and the impact on natural fisheries and aquaculture.

Conflicts of interest

The authors declare no conflict of interest.

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