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Research Article

Parasites species spectrum of *clarotes macrocephalus* from Lower and Upper river Benue, Nigeria

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Abstract

Investigation on the parasites of *Clarotes macrocephalus* from Lower and Upper River Benue was carried out for a period of ten months each of dry and rainy seasons. Out of the total (718) parasites observed in dry season, while site A recorded 50.28%, site B recorded 49.72%. Of the total (602) parasites recorded in rainy season, while site A recorded 52.49%, B recorded 47.51%. There was higher parasite prevalence (51.25%) and mean intensity (3.50) in dry season than the rainy season (46.00% and 3.27). In dry season, female fish from sites A and B had more percentage parasite load (52.91%) and (50.70%) than the males from same sites (47.09% and 49.03%) respectively. On the other hand in site A rainy season, male fish had more percentage parasite load (50.95%) than the females (49.05%) whereas in site B, females had more percentage parasite load (58.39%) than the male counterpart (41.61%). However, there was no significant difference (Chi square = 0.139) in parasite load between the female and male. The highest percentage parasite infestation (40.72% in site A and 38.10% in site B) in dry season and (49.37% from site A and 41.97% from site B) in rainy season were recorded in the length group 21.1-31cm. The least 1.11% in site A and 0.28% in site B in dry season were recorded in the length groups (51.1-61cm and 11-21cm) from sites A and B respectively whereas in rainy season, the least percentage parasite load (22.15%) in site A and 10.49% in site B were recorded in the length groups between 41.1– 51.0 cm and 11.0 – 21.0cm respectively. There was Variation in parasite load among the weight classes.

Keywords: Lower and Upper River Benue, Parasites, *Clarotes macrocephalus*, dry and rainy seasons

Introduction

Clarotes macrocephalus from the family bagridae is common in the commercial catches of those who live along the Upper and Lower River Benue where it immensely contributes to the income of the artisanal fishers and provides rich protein source in the diets of the populace. In Nigeria, fish consumption is increasing especially among the poor majority because of its affordability and health benefits (Ekanem *et al*., 2011) and also because of the rising cost of beef and other animal protein sources. Parasites and diseases are among a number of factors that hinder fish production, (Iyaji *et al*., 2009). This has become a serious concern since they often produce a weakening of the hosts' immune system thereby increasing their susceptibility to secondary infections, resulting in the nutritive devaluation of fish and subsequent economic losses (Onyedineke *et al*., 2009). Parasites of fish could also constitute health hazards to humans when ingested with poorly cooked fish (Ibiwoye *et al*., 2004). Catfish parasites from Nigerian water bodies include the works on helminth parasites of *Clarias gariepinus* in River Zaria (Oniye *et al*., 2004), helminth endoparasites of Mockokids in a Anambra River (Ezenwaji *et al*., 2005), gastrointestinal helminth parasites of *Synodontis clarias* from Lekki Lagoon, Lagos (Akinsanya *et al*., 2008), parasitic infestation of *Synodontis batensoda* at Rivers Niger and Benue and its Confluence at Lokoja (Eyo *et al*., 2012) and gastrointestinal helminth parasites of *Auchinoglanis occidentalis* and *Synodontis clarias* from lower River

Benue, Makurdi (Omeji, 2012) among others. However, no work has been done on the parasite species spectrum of the Bagrid catfish, *Clarotes macrocephalus* from Upper and Lower River Benue. It was important transportation route in the regions through which it flows. It rises in the Adamawa Plateau of northern Cameroon, from where it flowed west, and through the town of Garoua and Lagdo Reservoir into Nigeria south of the Mandara Mountains through Jimeta, Ibi and Makurdi before meeting the Niger at Lokoja. The river's largest tributary was the Mayo Kébbi, which connected it with the Logone River (part of the Lake Chad system) during floods. Other tributaries were Taraba River and River Katsina Ala River Benue divides the town into the North- and South-bank. The River existed year round though the water volume fluctuates with season. The river overflowed its banks during the rainy season (May-October), but decreased drastically in volume leaving tiny island in the middle of the river during the dry season (November-April). The river contained several species of freshwater fishes of different families including polypteridae and several others. The present study was aimed at determining the parasite species spectrum of large headed freshwater fish species (*Clarotes macrocephalus*) from Upper and Lower River Benue.

Materials and Methods

The study took place along the Lower (Wadata, Benue State as site A) and Upper (Mutum Biu, Taraba State as site B) River Benue. River Benue the major tributary of the Niger River and approximately 1400 km long and was entirely navigable during the summer months. A total of eight hundred fish were sampled for a period of 10 months each of dry and rainy seasons and examined for parasites. Fish were transported in ice to the laboratory from the sampling sites. In the laboratory the taxonomic identity of fish were confirmed (Reed *et al*., 1967; Olaosebikan and Raji, 1998), the sexes of the fish were determined by examination of their papillae, total length and standard length measured to the nearest 0.1 cm using a meter rule mounted on a dissecting board and weight measured with a digital top loading balance to the nearest 0.1 g. All techniques for examination of ecto and endo parasites were reported by Omeji, *et al* (2010), Bichi and Ibrahim, (2009) and Emere and Egbe (2006), Enayat (2011) as thus:

Examination of ectoparasites

The external surfaces-fins gills and skins were brushed into Petri dish containing normal saline and examined with hand lens for the presence of ectoparasites. The gills were dissected out and each gill filament and arch examined with hand lens for the presence of any parasite.

Examination of endoparasites

The fishes were dissected to expose the viscera. The visceral cavities and internal organs were examined for cyst and larval endoparasites. The guts were removed and placed in petri dishes. The contents were flushed with normal saline into beakers and then shaken to loosen mucus and other intestinal debris. Parasites were recovered from the residue after centrifugation and decanting of the supernatant.

Recovered parasites were mounted on slides and viewed using light microscope under higher magnification (x40) and identified. All parasites recovered were counted and recorded.

Treatment, preservation and fixation of parasites

Treatment, preservation and fixation of parasites were carried out using the techniques as reported by Kiernan (2008) as thus;

Microscopic parasites

Microscopic parasites were first stained for about 12 h in Haematoxylin and Eosin and transferred to 45% acetic acid for 2 min and placed in methyl salicylate for 1 min. The parasites were mounted in Canada balsam on clean slides.

Trematode digeneans

The parasites were placed in water to relax and stretch out fully before being fixed in alcohol formol acetic acid. They were mounted in Canada balsam.

Cestodes

They were fixed in 4% neutral formalin and dehydrated in ethanol. They were then stained with Eosin and mounted whole in Canada balsam.

Nematodes

Nematodes were placed in 70% ethyl alcohol and 5% glycerin added for storage. They were later stained with Eosin and mounted whole in Canada balsam.

Acanthocephalans

Acanthocephalan parasites were left overnight in a refrigerator to relax and exude the proboscis and then fixed in 70% ethanol to dehydrate them. They were then stained in Eosin and mounted on clean slides in Canada balsam.

Identification of parasites

Parasites collected were identified to species level using (Yamaguti, 1959).

Statistical analysis

The prevalence (%), mean intensity and abundance were analyzed according to Bush *et al*. (1997). The relationships between factors such as host sex, weight, total length, locality and parasitic infection were obtained from pooled data using analysis of variance (ANOVA). All statistical analysis were done using SPSS version 16 for windows.

Results

Results of the parasite species spectrum in *C. macrocephalus* from both sites in dry and rainy seasons are as shown in Table 1. Out of the 400 samples of *C. macrocephalus* collected in dry season, 195 (48.75%) were not infested by any parasite while 205 (51.25%) were infested with different parasites and were observed to harbour a total of 718 parasites. Out of the total parasites, while site A recorded 361 (50.28%) parasites from 102 (51.00%) infested fish samples, site B recorded 357 (49.72%) from 103 (51.50%) infested fish. *Diphilobothrium latum* was the most prevalent parasite from both sites (22.16% in site A and 24.37% in site B) while *C iubilans* and *Bothriocephalus aengypticus* (2.49% each) in site A and *Ichthophthirius mutifilis* (2.52%) in site B were the least. Of the body parts examined from both sites, intestine had the highest percentage parasite load 183 (50.69%) in site A and 213 (59.66%) in site B while the least 4(1.11%) and 4 (1.12%) from both sites A and B were recorded by skin. In rainy season on the other hand, of the 400 *C. macrocephalus* sampled, while 216 (54.00%) were not infested, 184 (46.00%) were infested harbouring 602 different parasites. Of the total number of parasites, while site A recorded 316 (52.49%) from 98(49%) infested fish, B recorded 286 (47.51%) from 86(43%). Among the parasite species encountered, *Diphilobothrium latum* was also the most prevalent from both sites (34.81%) and (32.52%); while *Hymenoplepis nanna* was the least (3.16%) in site A, *Ichthophthirius mutifilis* (0.70%) was the least in site B. Among the body parts of the examined fishes from both sites (A and B), intestine recorded the highest percentage load of parasites (164 (51.90%) 159 (55.59%)); while fin had the least 11 (3.48%) in site A, skin had the least 5 (1.75%) in site B. It was observed during the study period that there was higher parasite prevalence (51.25%) and mean intensity (3.50) in dry season than the rainy season (46.00% and 3.27) respectively.

Results of the relationship between sex and percentage parasite infestation of *C. macrocephalus* from both sites in both seasons are as shown in Figure 1. In dry season, female fish from sites A and B had more percentage parasite load (52.91%) in site A and (50.70%) in site B than the males from same sites (47.09% site A and 49.03% site B) respectively. In site A rainy season, male fish had more percentage parasite load (50.95%) than the females (49.05%) whereas in site B, females had more percentage parasite load (58.39%) than the male counterpart (41.61%). However, there was no significant difference (Chi square = 0.139) in parasite load between the female and male.

Results of the relationship between range in length (cm) and percentage parasite infestation of *C. macrocephalus* from both seasons are as shown in Figure 2. The highest percentage parasite infestation (40.72% in site A and 38.10% in site B) in dry season and (49.37% from site A and 41.97% from site B) in rainy season were recorded in the length group 21.1-31cm. The least 1.11% in site A and 0.28% in site B in dry season were recorded in the length groups (51.1-61cm and 11-21cm) from sites A and B respectively whereas in rainy season, the least percentage parasite load (22.15%) in site A and 10.49% in site B were recorded in the length groups between 41.1 – 51.0 cm and 11.0 – 21.0cm respectively. No parasite was recorded in the length groups between 11.0-21cm from site A in dry season. Also in rainy season, no

Table 1 . Parasites species spectrum in *C. macrocephalus* from both stations in dry and rainy seasons

PARASITIC SPECIES	LOCATION OF PARASITE	% OF EACH PARASITE ON EACH LOCATION IN DRY SEASON FROM		PERCENTAGE TOTAL OF EACH PARASITE SPECIES ON FISH IN DRY SEASON		% OF EACH PARASITE ON EACH LOCATION IN RAINY SEASON FROM		PERCENTAGE TOTAL OF EACH PARASITE SPECIES ON FISH IN RAINY SEASON	
		SITE A	**SITE A**	**SITE A**	**SITE B**	**SITE A**	**SITE B**	**SITE A**	**SITE B**
Trichodina sp	Fin	4.43	3.64	5.54	5.88	3.48	2.80	3.48	4.20
	Skin	1.11	0.84			0	0.35		
	Gill	0	1.40			0	1.05		
Clinostomum sp	Skin	0	0.28	3.60	3.36	0	1.40	5.06	4.19
	Gill	3.60	3.08			5.06	2.79		
I. mutifilis	Gill	5.54	2.52	5.54	2.52	4.11	0.70	4.11	0.70
Henneguya sp	Gill	3.32	1.12	5.59	5.88	2.53	0	5.38	3.50
	Intestine	2.23	4.76			2.85	3.50		
C. bridgae	Intestine	5.82	1.40	8.04	3.08	1.90	2.10	4.43	2.10
	Stomach	2.22	1.68			2.53	0		
Camalanus sp	Intestine	3.32	1.12	6.92	5.60	0.63	0	4.43	9.79
	Stomach	3.60	4.48			3.80	9.79		
H. nanna	Intestine	3.05	2.80	3.88	3.64	0	0	0	0
	Stomach	0.83	0.84			3.16	3.15	3.16	3.15
Eustrongylids	Intestine	3.32	7.00	11.35	9.24	12.34	10.49	12.34	10.49
	Stomach	8.03	2.24						
C. iubilans	Stomach	4.71	3.36	4.71	3.36	5.06	5.24	5.06	5.24
D. latum	Intestine	20.22	22.41	22.16	24.37	34.81	32.52	34.81	32.52
	Stomach	1.94	1.96						
Contracaecum sp	Intestine	3.88	3.08	9.14	6.16	5.38	5.25	5.38	5.25
	Stomach	5.26	3.08						
Capilaria sp	Intestine	6.93	7.56	11.09	14.28	8.55	9.08	8.55	9.08
	Stomach	4.16	6.72						
B.aengypticus	Intestine	1.94	5.60	2.49	8.68	3.80	4.90	3.80	4.90
	Stomach	0.55	3.08						
Acanthocephala	Intestine	0	3.92	0.00	3.92	0.00	4.90	0.00	4.90
	TOTAL	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

% host part infected = No of each part of host infected divided by the total number of all the parts of the host infected expressed as a percentage, % parasite load on each location = No. of each parasite divided by total No. of parasites observed expressed as a percentage, Total percentage parasite species on fish = Sum of the percentage parasite load on each location(s).

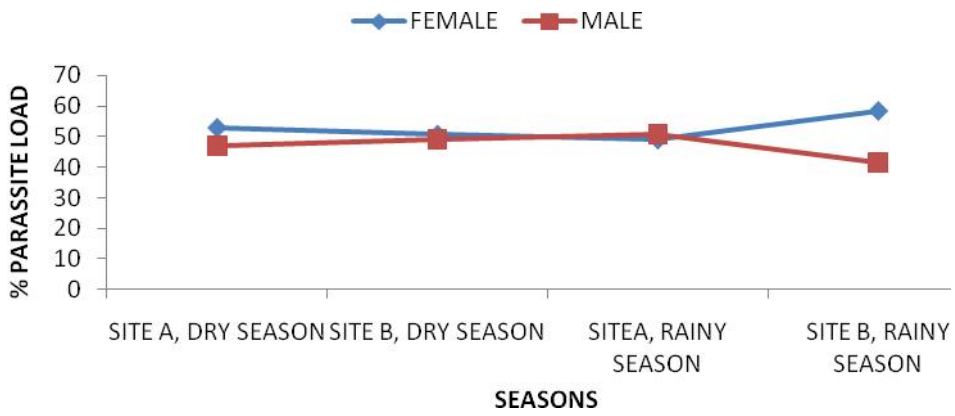

Fig. 1. Relationship between sex and parasite infestation of *C. macrocephalus* from both sites in both seasons.

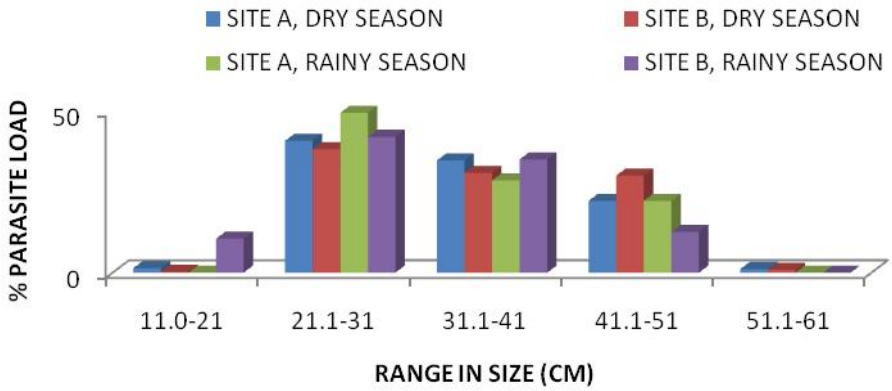

Fig.2. Relationship between length groups and percentage parasite infestation of *C. macrocephalus* from both seasons.

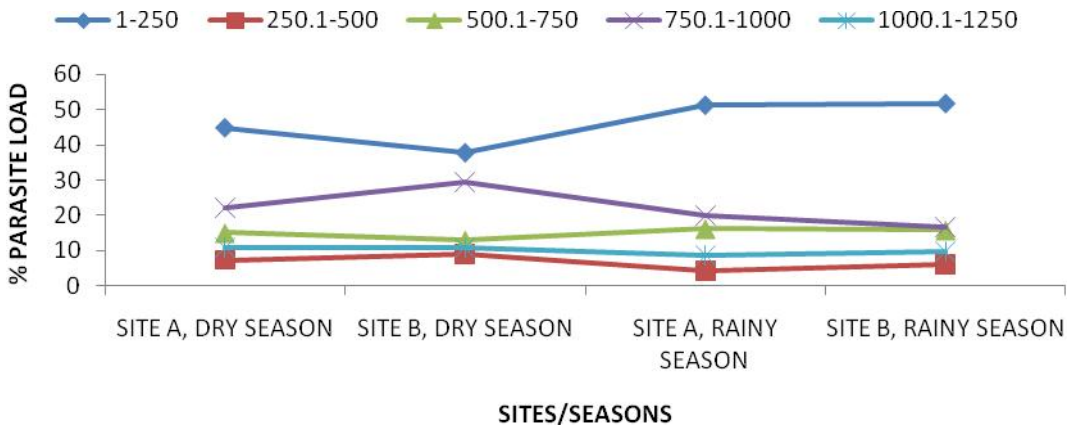

Fig.3. Relationship between weight and percentage parasite infestation of *C. macrocephalus* from both sides in both seasons.

parasite was recorded in the length groups between 51-61cm from sites A and B.

Results of the relationship between range in weight and percentage parasite infestation of *C. macrocephalus* from both sites in both seasons are as shown in Figure 3. The highest percentage parasite infestation (44.88% in site A and 37.87% in site B) in dry season and (51.27% from site A and 51.75% from site B) in rainy season were recorded in the weight ranges between 1-250g. The least (7.2% in site A and 8.96%) in site B in dry season and (4.11% from site A and 5.94% from site B) were recorded in the weight ranges between 250.1-500.0g respectively.

Discussion

A high overall infection prevalence of 48.63% in *C. macrocephalus* was observed during the study period. Dry season had higher infection rate (51.25%) than the rainy season (40.00%). Results on the prevalence of parasites of fish examined thet Benue River were consistent with the reports of Ezenwaji and Ilozumba (1992); Anosike *et al*., (1992), Nwani (2004) and Oniye *et al*. (2004) but disagrees with the reported work of Yakubu *et al.,* (2002) who reported high infection prevalence 59% in his comparative study of gut helminths of *Tilapia Zilli and Clarias gariepinus* from River Uke, Plateau State, Nigeria. Dankshaya and Zakari, (2007) reported 40.85% prevalence. Differences in prevalence could be explained largely in terms of the frequency of contact between the fish and the infective stage of the parasites. Benue River systems usually flow in very large volumes resulting from runoff from the systems' catchment areas during the flood phase of the hydrological regime. During this period, the volume of water enables a wide dispersal of both the parasites and their hosts, considerably reducing the contact between them. The high flow of water further ensures minimal contact and therefore low prevalence. Similar observation had been reported by Nwani *et al* (2008).

During the study period, intensity of parasitism varied with the seasons being more prevalent in the dry season (3.50) than the rainy season (3.27). In the dry season, which roughly corresponds to the dry phase of the hydrological cycle, there is virtually no precipitation and the flow and volume of water are very much reduced, resulting in much higher contact between the parasites and host fish leading to relatively higher prevalence that was observed during this period. Increased host-parasite contact frequency is a major reason why prevalence is higher, sometimes up 95% in lentic habitats, particularly in floodplain ponds, lakes and marshes and in culture situations (Anosike *et al*., 1992).

Apart from climate, other factors of considerable importance, which affect prevalence, are the environment of the host, behavior and life history of the parasites and host fish. Similar observation had also been made by Bichi and Dawaki (2010); Stressors (Kadlec *et al*., 2003) appear to have a moderating and sometimes overriding influence on prevalence. This may account for the disparity in prevalence of parasites during the dry and rainy seasons as well as the sampling sites in this study.

The high incidence of infestation obtained in bigger fish (> 11.0 – 21.00cm) is an indicator that size of the fish is important in determining the parasite load compared to small fish. Oniye and Aken'Ova (1999) and Tachia *et al.,* (2012) reported increase in the abundance of parasites with host size. Anosike *et al.* (1992) reported that number of parasites and its diversity increase with age of fish. Mohammed (1999) reported that prevalence was found to increase as the fish grows, and that could be attributed to the longer time of exposure to the environment by body size. The differences in parasite load could also be attributed to the random selection of the specimens and to probable high level of immunity built up in the fish specimens (Akinsanya *et al*., 2008). In addition, the higher percentage parasite load observed in the weight range between 1-250g (small fish) than those between 250-1250g (big fish) from both sites in both seasons could be attributed to the quest of the bigger fish for survival. In addition, bigger fish tend to cover wider areas in search of food. As a result, they take more food than the smaller ones and these expose them more to infestation by parasites. This agrees with the reported work of Ayanda (2009), Omeji *et al*., (2011), and Omeji *et al.,* (2013) but disagrees with the reported work of Tasawar *et al*., (2007) who reported higher parasite load in smaller fish than the bigger counterparts.

The higher incidence of infestation recorded in the female fish than the male could be due to the physiological state of the females, as most gravid

females could have had reduced resistance to infestation by parasites. In addition, their increased rate of food intake to meet their food requirements for the development of their egg might have exposed them to more contact with the parasites, which subsequently increased their chance of being infested. This observation agrees with the reported works of Emere and Egbe (2006) and Omeji *et al*., (2011) but disagrees with the reported works of Anosikel *et al.,* (1992), Oniye *et al.,* (2004) and Omeji *et al*. (2013) who reported more parasite infestation in male fish than the female.

Emere (2000) reported that differences in the incidence of infestation between male and female fish could be due to differential feeding either by quantity or quality of food eaten or as a result of different degrees of resistance and infection. In the reported work of Ibiwoye *et al*., (2004) female fishes were more frequently infected with parasites than males. According to Mhaisen *et al*., (1988) female fishes were generally more liable than males to infections with cestode, nematode, acanthocephalan, crustacean and copepod parasites.

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