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Parasites of *Clarotes laticeps* (Ruppell, 1832 Siluriformes, Bagridae) at Rivers Niger-Benue Confluence, Lokoja, Nigeria

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ABSTRACT

The Bagrid catfish, *Clarotes laticeps*, caught with various fishing gears in Rivers Niger and Benue at the confluence area, were subjected to monthly parasitological studies between March 2007 and February 2008 as part of a larger research work on parasites of Siluriformes in Nigerian freshwater ecosystem. A total of 126 *Clarotes laticeps* were examined, 76(60.3%) were infected, while 50 (39.7%) were uninfected with 546 parasites recovered. River Niger had the highest infection of 85.7%, while River Benue had the least infection of 28.6%. Seven parasite species were identified. These included 1 protozoan (Trichodinid ciliates), 3 cestodes (*Monobothrioides woodlandii*, *Bothriocephalus acheilognathii*, *Proteocephalus largoproglotis*) and 3 nematodes (*Procamallanus laevionchus*, *Rhabdochona congolensis* and *Contracaecum microcephalum*). Trichodinid ciliates recovered from the gills/skin of fish hosts had the highest overall prevalence (22.2%) among the parasites recovered in this study. The rest parasites were recovered from the intestines. The relationship of host size (weight/length) and parasite infection showed there was no significant difference in the infection ($p>0.05$) among size classes, although fish of larger sizes had more infections. There was also no significant difference in the infection of the sexes. This study is the first attempt to document and contribute to the knowledge of parasitic fauna of the Bagrid catfish *Clarotes laticeps* in Rivers Niger and Benue at the Confluence area.

Key words: *Clarotes laticeps*, niger-benue confluence, parasitic helminth, trichodinid ciliates, cestodes, nematodes

INTRODUCTION

The Bagrid catfish, *Clarotes laticeps* inhabits rivers and swamps and is endemic to river systems in Africa. According to Reed *et al.* (1967), the species are reputed to feed heavily on insects, copepods, mollusks and smaller fish and grow to at least 700 mm length and a weight of about 8 kg. They are common in commercial catches at the confluence area where they contribute significantly to the income of the artisanal fishers and provide 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 with exception of poultry raised eggs. Among a number of factors that limit fish production, are parasites and diseases which cause a host of pathological debilities in them (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 (Kabata, 1985; Ibiwoye *et al*., 2004).

Several researches on catfish parasites from Nigerian water bodies include the works on helminth parasites of the gastrointestinal tract of *Synodontis* species in River Zaria (Auta *et al*., 1999), 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 parasitic fauna of the Bagrid catfish, *Clarotes laticeps* from the Rivers Niger and Benue and its confluence. This study investigated the parasites of the catfish, *Clarotes laticeps* in the major rivers of Niger and Benue at the confluence area in Lokoja, Nigeria.

MATERIALS AND METHODS

The study area was located around the confluence of rivers Niger and Benue between latitude 7°45'N to latitude 8°12'N and longitude 6°39'E to longitude 7°00'E (Fig. 1). Both rivers are characterized with extensive flood plains, numerous perennial ponds and marshes on both banks of the rivers before and within the confluence. On banks of the rivers are mainly vegetation of wooded savanna with few shrubs and trees. The climate of the area consists of the dry and wet seasons inter-spread with harmattan wind during the early dry season. The duration of the wet season is end of March to end of October or early November, while the dry season begins in November and lasts until late March. *Clarotes laticeps* were sampled from fishers using multiple of fishing gears (set nets, cast nets, hooks, gill nets, etc) at three locations: locality 1: Ohono village (Niger River); locality 2: Mozum village (Benue River) and locality 3: Ganaja village (confluence).

Fish were sampled for 12 months and examined for parasites. The protocols for examination of fish for endo and ecto-parasites were as reported by Arthur and Albert (1994) and EMAN (1999). 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) and preliminary data recorded were; date caught, locality from which the fish were caught, sex of fish hosts, 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.

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 monogeneans and myxosporidean cysts.

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 (1000 rpm) and decanting of the supernatant. Recovered parasites were

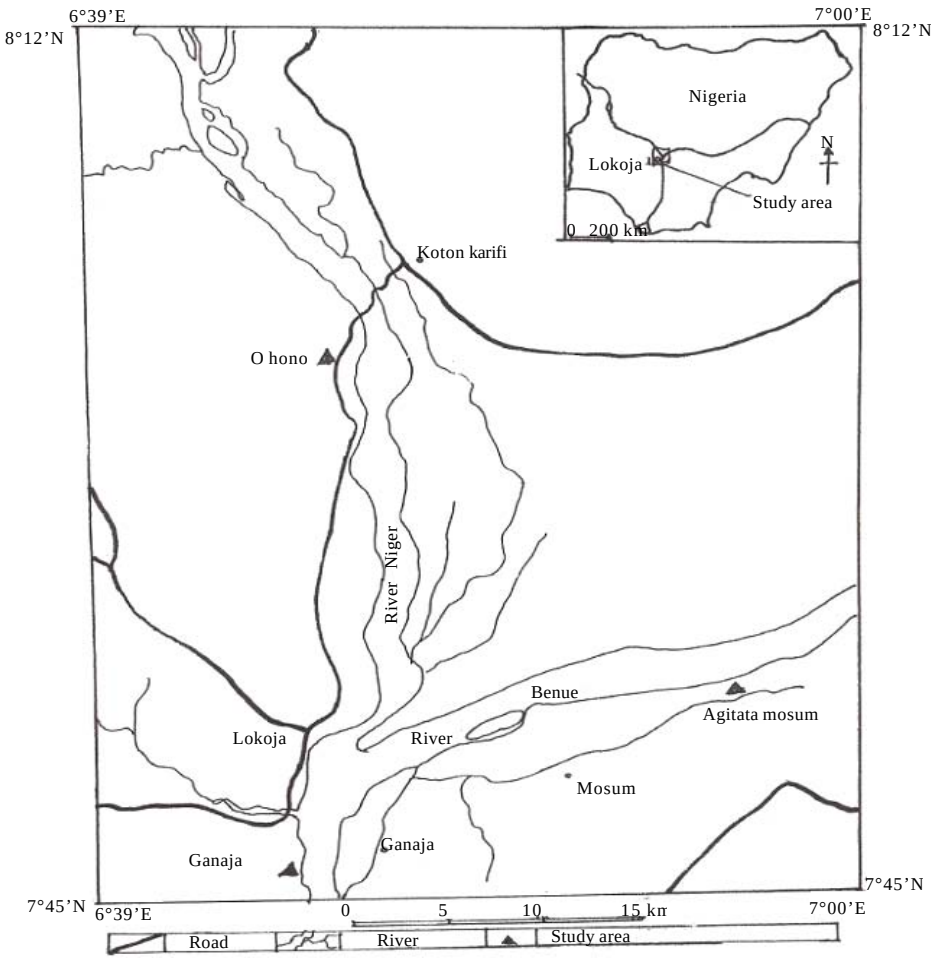

Fig. 1: Map of the study area showing the confluence of rivers Niger/Benue at Lokoja Nigeria. Source: SPDC in 2000

mounted on slides and viewed using Olympus light microscope under higher magnification (×40) and identified. All parasites recovered were recorded. Fish not examined were refrigerated (-4°C) overnight and examined the following day for parasites.

Treatment, preservation and fixation of parasites

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: Collected parasites were identified to species level using (Yamaguti, 1959; Paperna, 1996; Moravec, 1998; Chambrier and Vaucher, 1999).

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, standard length, locality and parasitic infection were obtained from pooled data using analysis of variance (ANOVA). All statistical analysis were done using SPSS version 15 for windows.

RESULTS

A total of 126 *Clarotes laticeps* were examined for parasites. Seventy six (60.3%) were infected while 50 (39.7%) were uninfected with a total parasite of 546 recovered. The number of fish hosts in each locality was 42. Thirty six hosts (85.7%) were infected in Locality 1 (R. Niger), 12 (28.6%) were infected in Locality 2 (R. Benue) while 28 (66.6%) were infected in Locality 3 (Confluence). Parasites recovered were 218 for locality 1, 210 for locality 2 and 118 for locality 3.

Parasite taxa and species encountered included the Protozoan ciliates, Trichodinids; the Cestodes, *Bothriocephalus acheilognathii*, *Monobothroides woodlandii*, *Protocephalus largoprosglotis*; the Nematodes, *Procamallanus laevionchus*, *Rabdochona congolensis* and *Contracaecum microcephalum* (Table 1). Trichodinids were recovered from the gills and skin of fish hosts while the helminths were recovered from the intestines. Among the parasites that infected *C. laticeps*, Trichodinids has the highest overall prevalence of 22.22%, while the rest parasites infection ranged between 1.59% in *R. congolensis* and *C. microcephalum* and 17.46% in *B. acheilognathii*.

Trichodinids and *B. acheilognathii* were found across the 3 localities with highest prevalence of 28.57% and 23.81% respectively in R. Niger (Table 2). Infection by nematodes was very low, with the highest prevalence of 3.19% by *P. laevionchus*. No nematode parasite was found in Locality 2 (R. Benue).

Infections of *C. laticeps* by body weight showed no definite pattern but were found across all weight categories except in 76-100 g weight where no parasite was found. However, the highest prevalence of Trichodinids (28.6%), *M. woodlandii* (17.9%), *B. acheilognathii* (25%) and

Table 1: Parasitic infestation of *Clarotes laticeps* at the Rivers Niger, Benue and its confluence

Parasite groups	Parasite species	No. of hosts examined	No. of hosts infected	No. of parasite recovered	Prevalence (%)	Mean intensity	Abundance
Protozoan	Trichodinids	126	28	452	22.22	16.14±26.21	3.59
Cestodes	*M. woodlandi*	126	12	16	9.52	1.33±0.82	0.13
	B. acheilognathii	126	22	54	17.46	2.45±1.44	0.43
	P. largoproglotis	126	6	12	4.76	2.00±1.73	0.10
Nematodes	*P. laevionchus*	126	4	8	3.17	2.00±1.41	0.06
	R. congolensis	126	2	2	1.59	1.0	0.02
	C. microcephalum	126	2	2	1.59	1.0	0.02

P. largoproglotis (7.1%) were in 100 g weight category. The nematode parasites infected hosts of between 26-75 g weight categories (Table 3). In the length category, most parasites were found in 11-30 cm categories (Table 4). Infections were not significant in the weight or length categories, except Trichodinids in 30 cm where the two large fish examined were infected.

Table 2: Parasitic infestation of *Clarotes laticep* at the three localities (Rivers Niger, Benue and its confluence)

	River Niger (N = 42)						River Benue (N = 42)						Confluence (N = 42)					
Parasite	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
Trichodinids	42	12	164	29.0	13.67±16.08	3.9	42	6	204	14.0	34±55.43	5	42	10	84	24.0	8.40±7.13	2.0
M. woodlandii	42	6	6	14.0	1	0.1	0	0	0	0.0	0	0	42	6	10	14.0	1.67±1.15	0.2
B. acheilognathii	42	10	30	24.0	3±1.58	0.7	42	4	4	9.5	1	0	42	8	20	19.0	2.50±1.29	0.5
P.largoproglotis	42	4	10	9.5	2.5±2.12	0.2	42	2	2	4.8	1	0	0	0	0	0.0	0	0.0
P. laevionchus	42	2	6	4.8	3	0.1	0	0	0	0.0	0	0	42	2	2	4.8	1	0.1
R congolensis	0	0	0	0.0	0	0.0	0	0	0	0.0	0	0	42	2	2	4.8	1	0.1
C.. microcephalum	42	2	2	4.8	1	0.1	0	0	0	0.0	0	0	0	0	0	0.0	0	0.0

A: No.of fish hosts infected, B: Total No. of parasites recovered per host, C: Percentage prevalence, D: Mean intensity of parasite, E:Abundance of parasite

Table 3: Parasitic infestation of *Clarotes laticeps* by body weight at the Rivers Niger, Benue and its confluence

	Body weight classes (g)																					
	0-24 (N = 6)					26-50 (N = 34)					51-75 (N = 22)					76 - 100 (N = 8)					100+ (N = 56)				
Parasite species	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Trichodinids	0	0	0	0	0.0	6	106	18	3	3	6	48	27.3	2.18	2.2	0	0	0	0	0	16	298	28.6	5.3	5.32
M. woodlandi	0	0	0	0	0.0	2	2	6	0	0	0	0	0.0	0.00	0.0	0	0	0	0	0	10	14	17.9	0.3	0.25
B. acheilognathii	2	2	33	0	0.3	0	0	0	0	0	6	8	27.3	0.36	0.4	0	0	0	0	0	14	44	25.0	0.8	0.79
P. largoproglotis	0	0	0	0	0.0	2	2	6	0	0	0	0	0.0	0.00	0.0	0	0	0	0	0	4	10	7.1	0.2	0.18
P. laevionchus	0	0	0	0	0.0	2	6	6	0	0	2	2	9.1	0.09	0.1	0	0	0	0	0	0	0	0.0	0.0	0.00
R. congolensis	0	0	0	0	0.0	0	0	0	0	0	2	2	9.1	0.09	0.1	0	0	0	0	0	0	0	0.0	0.0	0.00
C. microcephalum	0	0	0	0	0.0	2	2	6	0	0	0	0	0.0	0.00	0.0	0	0	0	0	0	0	0	0.0	0.0	0.00

A: No. of fish hosts infected, B: Total No. of parasites recovered per host, C: Percentage prevalence, D: Mean intensity of parasite, E: Abundance of parasite

Table 4: Parasitic infestation of *Clarotes laticeps* by standard length at the Rivers Niger, Benue and its confluence

	Standard length classes (cm)																			
	0-10 (N = 6)					11-20 (N = 90)					21-30 (N = 26)					30+ (N = 4)				
Parasite species	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
Trichodinids	0	0	0	0.0	0	20	408	22.20	4.5	4.5	4	28	15	1.08	1.1	4	16	100	4.0	4
M. woodlandi	0	0	0	0.0	0	4	4	4.44	0.0	0.0	6	10	23	0.38	0.4	2	2	50	0.5	1
B. acheilognathii	2	2	33	0.3	0	10	22	11.10	0.2	0.2	8	22	31	0.85	0.9	2	8	50	2.0	2
P. largoproglotis	0	0	0	0.0	0	2	2	2.22	0.0	0.0	4	10	15	0.38	0.4	0	0	0	0.0	0
P. laevionchus	0	0	0	0.0	0	4	8	4.44	0.1	0.1	0	0	0	0.00	0.0	0	0	0	0.0	0
R congolensis	0	0	0	0.0	0	2	2	2.22	0.0	0.0	0	0	0	0.00	0.0	0	0	0	0.0	0
C. microcephalum	0	0	0	0.0	0	2	2	2.22	0.0	0.0	0	0	0	0.00	0.0	0	0	0	0.0	0

A: No. of fish hosts infected, B: Total No. of parasites recovered per host, C: Percentage prevalence, D: Mean intensity of parasite, E: Abundance of parasite

Table 5: Parasitic infestation of male and female *Clarotes laticeps* at the Rivers Niger, Benue and its confluence

	Male (N = 92)					Female (N = 34)				
Parasite species	A	B	C	D	E	A	B	C	D	E
Trichodinids	22	236	23.91	15.27±28.08	3.65	6	116	17.65	19.33±22.50	3.41
M. woodlandi	10	14	10.87	1.40±0.89	0.15	2	2	5.88	1	0.06
B. acheilognathii	14	30	15.22	2.14±1.21	0.33	8	24	23.53	3.00±1.83	0.71
P. largoproglotis	4	4	4.35	1	0.04	2	8	5.88	4	0.24

A: No. of fish hosts infected, B: Total No. of parasites recovered per host, C: Percentage prevalence, D: Mean intensity of parasite, E: Abundance of parasite

Infections of *C. laticeps* by sex (Table 5) showed that males were more infected by Trichodinids, *M. woodlandii* and *P. largoproglotis* while females had more infections by *B. acheilognathii*. Many of the *C. laticeps* examined had mollusks, insect parts, shrimps, fish and digested materials in their stomach contents.

DISCUSSION AND CONCLUSION

The study showed a high overall infection prevalence of 60.31% in *C. laticeps* examined. River Niger recorded the highest infection (85.7%) while River Benue had the least (28.6%). The high prevalence of infection on river Niger compared to river Benue could be due to higher turbidity of river Niger compared to river Benue. River Niger which has its source on the Fouta Djalon Mountains in the Republic of Guinea (Lae *et al*., 2004) passes through four West African countries and has several tributaries and thus has more pollutants compared to river Benue which rises from the Adamoua massif in the nearby Republic of Cameroon and has lesser tributaries. An observation of the two water bodies at the Confluence showed that river Niger is cloudy or turbid while river Benue is clearer and dark in colour. The differences in the colour of the two water bodies could be observed for several kilometers downstream after the water bodies joined at the Confluence.

Heavy parasite infection in fish has been linked to environmental contamination by different pollutants, including heavy metals and hydrocarbons (Schludermann *et al*., 2003; Williams and Mackenzie, 2003) and organic enrichment of sediments by domestic sewage (Marcogliese and Cone, 2001). Khan and Thulin (1991) and Kemp and Spotila (1997) reported that urban effluents promote aquatic pollution, thus making aquatic organisms vulnerable to increased incidence of parasites. The high infection rate of *C. laticeps* in R. Niger could therefore, be attributed to the contamination of the river by various pollutants from the various West African countries and the numerous tributaries along the river course.

Among the parasites that infected *C. laticeps*, the protozoan ciliate, Trichodinids had the highest infection rates across the localities. The ciliates and flagellates have been reported (Klinger and Floyd, 2002) to have direct life cycles and may build up to high numbers when fish are crowded causing weight loss, debilitation and mortality. Fish were observed to be in good condition which could be due to general low infection rates and sparse population of *C. laticeps* in the localities. The high infection of *C. laticeps* by the cestode parasites in this study could be due to the ingestion of eggs, copepods and mollusks which serve as intermediate hosts of the larval stages of the cestodes (Paperna, 1996). *C. laticeps* is reputed to feed heavily on insects, copepods, mollusks and smaller fish, Reed *et al*. (1967). No adverse effects were observed in the fish hosts infected. Nematode parasites were understandably few in *C. laticeps* because they are associated with fish hosts that feed on mud, debris or detritus as found in most *Synodontis* species (Iyaji, 2011).

Higher prevalence and mean intensity in fish of large weight class (100 g) examined indicated the increase in parasitism with increase in size which is also related to age. Several researches also affirmed positive correlations between host age/size and increase in parasitism (Betterton, 1974; Madhavi and Rukmini, 1991; Chandler *et al*., 1995; Brickle *et al*., 2003). Standard length in fish is also related to age (Shotter, 1973) and fish body size. Poulin (2000) argued that older fish have longer time to accumulate parasites than younger ones and would provide more internal and external space for parasite establishment and therefore, tend to have heavier worm burdens. This is because they eat more parasitized prey and offer larger surface area for skin attaching parasites. Munoz and Cribb (2005) opined that this pattern might be explained by the combination of resources, time and prey. In the length categories, highest prevalence and mean intensity were recorded in fish of 30 cm but more infections were found in fish of intermediate (11-30 cm) length categories. High infections had also been reported in fish of intermediate standard lengths in other studies (Hanek and Fernando, 1978a, b; Obiekezie *et al*., 1988; Valtonen *et al*., 1990; Owolabi, 2005; 2007). Although males were infected with more parasites species, infections were not significant in both males and females of *C. laticeps*.

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