Journal of Aquatic Sciences 19(2): 71 – 75 (2004)

HELMINTH PARASITES OF *CLARIAS GARIEPINUS* (TEUGELS) IN ZARIA, NIGERIA

S. J. ONIYE*, D. A. ADEBOTE AND O. I. AYANDA.
Department of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria
*Corresponding author: sjoniye@yahoo.com

ABSTRACT

A total of 240 *Clarias* gariepinus (Teugels) were randomly purchased from fish landings in Sabon-gari market, Zaria. The fish were examined parasitologically for gastrointestinal parasites. Five species of helminth parasites comprising 3 cestodes, 1 nematode and 1 acanthocephala were isolated from the fish. The cestodes and their prevalence were *Anomotaenia* sp. (2.5%), *Monobothrium* sp. (13.33%) and *Polyonchobothrium clariae* (1.67%). The nematode, *Procamallanus laevionchus* and the acanthocephalan, *Neoechinorhynchus rutili* had a prevalence of 0.83% and 0.83% respectively. Majority of the parasites were found in the intestine. Infection was limited to fish with length ranging from 30.0 – 39.9 cm (prevalence: 15.83%; mean intensity: 3.78) and 40.0 – 49.9 cm (prevalence: 3.33%; mean intensity: 2.5) Fish specimens that were lighter in weight (150.0 – 299.9 g) were free of infection, but those found with parasites weighed between 350.0 – 399.0 g (prevalence, 7.5%) and 450.0 – 500.0 g (prevalence 6.67%). There was no statistically significant difference ($P > 0.05$) in the infection of the male and female *C. gariepinus*. The study highlights the importance of changing feeding habit of *C. gariepinus* with age on the prevalence and intensity of gastrointestinal parasites, and parasitised male fish have lower condition factor than unparasitised ones.

KEYWORDS: Helminth, parasites, *Clarias gariepinus*, Zaria.

INTRODUCTION

Clarias gariepinus (Teugels) is very common in swamps, lakes and rivers throughout Africa (Viveen *et al.*, 1977), and in the catches of fishermen throughout the year in Zaria. It is highly priced and requested for by fish farmers and consumers in Nigeria, either as smoke-dried or fresh. Studies on the biology, nutrition/growth and management of catfish have been carried out (Viveen *et al.* 1977; Faturoti *et al.* 1986; Jeje, 1992; Adeyemo *et al.* 1994; Eyo and Olatunde, 2001; Banyighi *et al.* 2001; Ovie and Ovie, 2002). Irrespective of these, various parasites are associated with *C. gariepinus* in the wild and culture environment, where they cause morbidity, mortality and economic losses in aquaculture practice in the world (Subashinghe, 1995).

Studies have revealed a rich parasitic fauna in some fresh water fish species of Nigeria (Awachie, 1966; Onyia, 1970; Aderounmu and Adeniyi, 1972; Onwuliri and Mgbemena, 1987; Ugwuzor, 1987; Umoren *et al.*, 1988), but only a few known to us are specifically directed to address the parasites of the gastrointestinal tract of *C. gariepinus* (Akogun and Goddard, 1989; Anosike *et al.* 1992; Basu *et al.* 1993). In spite of the premium placed on this catfish in Zaria, existing information is based only on its gill parasites (Aken'Ova and Shotter, 1988; Aken'Ova, 1999a and b). This study therefore reports on the parasitic fauna of the gastrointestinal tract of *C. gariepinus* in Zaria area, Nigeria.

MATERIALS AND METHODS

A total of 240 *Clarias gariepinus* caught from several water bodies around Zaria were purchased (alive) from fresh fish sellers in Sabon-gari market, Zaria, between March and July 2002. In the laboratory, the standard length (cm) and weight (g) of the fish were measured. The Fulton's condition factor, defined as weight percent divided by the cube of the length of fish (Ikomi and Odum, 1998) was calculated for each fish.

The fish were dissected to expose the alimentary canal, which was isolated. Its various sections (oesophagus, stomach, intestine and rectum) were placed separately in petri dishes containing normal physiological saline. Each section was slit longitudinally and examined for parasites under a dissecting microscope. Parasites found were counted, placed in physiological saline overnight in the refrigerator to enable it stretch and relax, and thereafter, fixed and preserved in 5% formalin. Representative of each parasite was stained overnight with a weak solution of Erlichs haematoxylin. The worms were then passed through graduated alcohol (30%, 50%, 70%, 90% and absolute) for 45minutes each to dehydrate, then cleared in methyl-salicylate and mounted on a slide in Canada balsam. Parasites were identified by using the texts of Yamaguti (1959 and 1961), Markevich (1963), Petrochenko (1971), Cheng (1973), Soulsby (1982), William and Jones (1994) and Paperna (1980; 1996). The terms prevalence and mean intensity were applied as defined by Margolis *et al.* (1982). Correlation coefficient and Student's t-test statistics were employed to test for significance.

RESULTS

Out of the 240 fish examined, 46 (19.17%) were infected by 164 helminth parasites, which comprised of three types of cestodes, one acanthocephalan and a

© Nigerian Association for Aquatic Sciences (ISSN: 0189 – 8779)

nematode (Table 1). The cestode, *Monobothrium* sp. occurred in the majority, 32 (13.33%), of the infected fish while the nematode, *Procamallanus laevionchus* and the acanthocephalan, *Neoechinorhynchus rutili* occurred in the minority (0.83% each) of the fish. All the parasites were restricted to the intestine except for *Monobothrium* sp. that was also found in the stomach as well as in the rectum (Table 1).

Fish with standard length ranging from 30.0 - 39.9 cm had the highest prevalence (15.83%) and mean intensity (3.78), while those with standard length of 40.0 - 49.9 cm had the least prevalence (3.33%) and mean intensity (2.5). Only these two standard length ranges were positive for parasitic infections (Table. 2). There was high correlation ($r = 1.0$) between the standard length and fish infected, parasites recovered, prevalence and intensity of infection.

Fish that weighed 150.0-299.0g were not infected; those that weighed between 350.0 - 399.0 g had the highest prevalence (7.5%) while the least prevalence (0.83% and 0.83%) were recorded in those fish that weighed 400.0 - 449.0 g and 550.0 - 599.0 g respectively (Table 3). Independent *t*-test analysis revealed no significant difference ($P > 0.05$) in the condition factor of infected and uninfected female fish, but that of the males differs significantly ($P < 0.05$) (Table 4).

The prevalence of infection (15.0%) and intensity (4.11) in male fish were higher than in the female (4.17% and 1.6 respectively). Student's *t*-test revealed lack of significant difference ($P > 0.05$) in the prevalence and intensity of infection between sexes.

DISCUSSION

Clarias gariepinus in Zaria area were infected by five helminth parasites that comprised of three species of cestodes, a nematode and an acanthocephalan. The cestodes are *Polyonchobothriium clariae, Monobothrium* sp. and *Amonotaenia* sp.; the nematode was *Procamallanus laevionchus*, and an acanthocephalan, *Neoechinorhynchus rutili.* The overall prevalence of these parasites in this study was low (19.17%) compared with 52.0% and 34.67% in cultured and wild populations of *C. gariepinus* respectively (Anosike *et al.*, 1992) and 59.8% in cultured and 63.0% in wild populations of *C. lazera* (Onwuliri and Mgbemena, 1987). Williams and Jones (1994) suggested that parasitism varies from one aquatic ecosystem to the other and this is influenced by the interplay of mixed biotic and abiotic factors. It is likely that the low prevalence of parasites in this study was due to decreased contact between host and parasite in the wild in comparison with culture situation where overcrowding in fish pond results in higher parasitism. A similar finding was reported by Anosike *et al.* (1992)

The predilection sites for the majority (89.0%) of the parasites was the intestinal lumen in contrast to 9.8% and 1.2% that were found in the stomach and rectum respectively. This finding is attributed to the fact that 60.0% of the parasites were cestodes. Anatomically, cestodes lack digestive system and obligatorily depend on end products of digested food in host, which are absorbed through the body surfaces, hence they are localized in the host intestine where their nutritional requirements are satisfied. Buchmann and Lindenstrom (2002) suggested that parasites have a built-in molecular disguise to avoid the host hostile secretions present in its microhabitat.

Monobothrium sp. was the only parasite that was found in the stomach where it was inactive, unlike the ones in the intestinal lumen that were motile. The parasite may have been hatched from an intermediate host that probably formed the food component of the fish, only for it to become active in the intestine where the microhabitat was conducive. Implicated intermediate hosts include cyclops, insects and other aquatic arthropods (Anosike *et al.*, 1992) and other small fish (*Oreochromis niloticus*) that may act as first vertebrate host, that were found in the stomach of *C. gariepinus.*

Some of the parasites encountered in this study and their related species have been labeled as causative agents of various debilities in fish. For instance, *Monobothrium hunteri* and *M.ulmeri* penetrate the intestinal wall and provoke nodule formation with a pronounced inflammatory reaction and necrotic debris (Williams and Jones, 1994). Similarly, *Polyonchobothrium clariae* causes inflammation of gut mucosa and its bothridium penetrates the gall bladder mucosa and initiates the formation of nodules in *Clarias gariepinus* (Paperna, 1996). *Neoechinorhynchus rutili,* like several other acanthocephalans, attaches to the epithelial mucosa where the extent of damage is proportional to the depth of penetration of the proboscis (Paperna, 1996). In contrast to these, *Procamallanus laevionchus* is equipped with an alimentary canal and would therefore roam around the intestine where it could graze on nutrients. This parasite is widely distributed in several fish hosts in Russia, Europe and Africa (Markevich, 1963, Ugwuzor, 1987, Onwuliri and Mgbemena, 1987, Auta *et al.*, 1999).

An increase in size is a reflection of increase in length and weight, which is hereby considered as a measure of age. Therefore the juvenile fish had no parasite while sub-adults and adults had higher prevalence of infection. A plausible explanation for this is the change in diet from weeds, seeds, phyto- and zooplanktons as juveniles to insect larvae, snails, crustaceans, worms and fish as adulthood is attained (Reed *et al.*, 1967). *Clarias* spp. are known to be omnivorous with the tendency towards being carnivorous as they age. These therefore point to the absence of an infective organism in the type of diet of the fish while young, and the contrast is the case in adults. Our findings tend to support that of Geets and Ollivier (1996) who postulated that herbivorous fish are generally considered to harbour less intestinal parasites than omnivorous or carnivorous; thus when *C. gariepinus* were juveniles, they tend to be herbivorous.

Table 1: Prevalence of intestinal helminth parasite in *Clarias gariepinus* (n = 240) on sale in Zaria, Nigeria

Parasite species	Taxonomic group	Number of fish infected	Prevalence (%)	Number of parasites in stomach	Number of parasite in intestines	Number of parasites in rectum
Amonotaenia sp.	Cestoda	6	2.50	-	10	-
Monobothrium sp.	Cestoda	32	13.33	16	128	2
Polyonchobothrium clariae	Cestoda	4	1.67	-	4	-
Procamallanus laevionchus	Nematoda	2	0.83	-	2	-
Neoechinorhynchus rutili	Acanthocephala	2	0.83	-	2	-
Total		46	11.96			

Table 2. Pattern of intestinal helminth infection in *Clarias gariepinus* on sale in Zaria in relation to their standard length

Standard length (cm)	Number (%) of fish examined	Number (%) of fish infected	Total number of parasite recovered	Prevalence (%)	Intensity
10-19.9	2 (0.83)	-	-	-	-
20-29.9	50 (20.83)	-	-	-	-
30-39.9	176 (73.33)	38 (21.50)	144	15.83	3.78
40-49.9	12 (5)	8 (66.67)	20	3.33	2.5
Total	240	46	164	19.16	-
Correlation (*r*) with standard length	0.26	1.0	1.0	1.0	1.0

Table 3: Pattern of intestinal helminth infection in *Clarias gariepinus* on sale in Zaria in relation to their body weight

Body weight (g)	Number (%) of fish examined	Number (%) of fish infected	Total number of parasite Recovered	Prevalence (%)
150 - 199	2 (0.83)	-	-	-
200 - 249	2 (0.83)	-	-	-
250 - 299	26 (10.83)	-	-	-
300 - 349	26 (10.83)	4 (15.38)	56	1.67
350 - 399	92 (38.33)	18 (19.57)	46	7.6
400 - 449	16 (6.67)	2 (12.5)	10	0.83
450 - 499	58 (24.12)	16 (27.59)	30	6.66
500 - 549	16 (6.67)	4 (25)	12	1.67
550 - 599	2 (0.83)	2 (100)	10	0.83
Total	240 (100)	46 (100)	164	19.16

Table 4: Monthly mean (±SE) condition factor of parasitised and non-parasitised male and female *Clarias gariepinus* in Zaria area.

Months	Male		Female	
	Infected	Uninfected	Infected	Uninfected
March	1.12 (±0.07)	2.03 (±0.24)	0.00 (±0.00)	1.77 (±0.22)
April	0.94 (±0.05)	1.67 (±0.33)	1.09 (±0.00)	1.62 (±0.30)
May	0.99 (±0.09)	0.91 (±0.04)	1.12 (±0.00)	1.02 (±0.04)
June	0.86 (±0.09)	0.99 (±0.04)	0.83 (±0.00)	0.96 (±0.13)
July	1.02 (±0.30)	1.38 (±0.09)	1.32 (±0.00)	1.54 (±0.16)
Total	1.03 (± 0.01)	1.33 (± 0.09)	1.09 (± 0.08)	1.31 (± 0.09)

The examined fish population shows that the male were more than the female. Higher prevalence and mean intensity of parasites were found in male than in female fish. These unequal parasitemia may be associated with Size of fish therefore had a marked relationship with helminth parasitism in *C. gariepinus* of Zaria area; this is also in agreement with the findings of Anosike *et al.* (1992). It is likely that utilization of different age classes

of the host by parasites is a special kind of temporal niche and or reproductive segregation (Geets and Ollivier, 1996) the time of this study (March to July, 2002), which coincided with reproductive period of *C. gariepinus* in Zaria, because nearly all females encountered were gravid. Spawning fishes are known to be less active and this may reduce their chances of contacting the infective stages of the parasites (Anosike *et al.*, 1992). The hormone level in *C. gariepinus* might have played an important role in the prevalence of infection in this study. Lees and Bass (1960) suggested that the increased level of the hormone, ostradiol, in frog during breeding season was associated with the reduction of helminth parasites. However, this differences in the prevalence of infection in male and female of *C. gariepinus* was statistically insignificant ($P > 0.05$). The lack of significant difference in the condition factor of the infected and uninfected females may be attributed to the presence of eggs and invariably lipids in the majority of the spawning fish. However the absence of this phenomenon in the males clearly revealed the effect of parasitism on the condition factor of the male fish, as parasitised male fish have lower condition factor than unparasitised ones. Condition factor is an indication of the well-being or robustness of a fish (Tesch, 1968).

In conclusion, the food items, age and spawning behaviour contributed to the type of helminth parasites of the gastrointestinal tract of wild *C. gariepinus* of Zaria area. It may be advisable to incorporate antihelminthic therapy into the diet of *C. gariepinus* obtained from the wild that might be used as broodstocks. In-depth understanding of the interplay between food items, length-weight, fecundity and elucidation of life cycle of parasites of the fish will have to await further studies.

REFERENCES

Aderounmu, E. A. and Adeniyi, F. (1972). Cestodes in fish from a pond at Ile-Ife, Nigeria. *The African Journal of Tropical Hydrobiology and Fisheries* 2(2): 151 – 156.

Adeyemo, A. A., Oladosu, G. A. and Ayinla, A. O. (1994). Growth and survival of fry of African catfish species, *Clarias gariepinus* Burchell, *Heterobranchus bidorsalis* Geoffery and *Heteroclarias* reared on *Moina dubia* in comparison with other first feed sources. *Aquaculture 119:* 41 – 45.

Aken'Ova, T. O. and Shotter, R. A. (1988). Ectoparasitic protozoans of the gills of *Clarias* sp. *The Nigerian Journal of Parasitology. 9 - 11*: 129 – 137.

Aken'Ova, T. O. (1999a). Copepod parasites of the gills of *Clarias* species in two lakes and a river in Zaria, Nigeria. *The Nigerian Journal of Parasitology 20*: 99 – 112.

Aken'Ova, T. O. (1999b). Helminth infection of the gills of *Clarias* species in Zaria. *The* Nigerian *Journal of Parasitology, 20*: 113-121.

Akogun, O. B. and Goddard, J. P. (1989). Parasites of *Clarias submarginatus* and *C. gariepinus* from the Benue River at Yola, Nigeria. *Annals of Borno* 6/7: 115 – 120.

Anosike, J. C., Omoregie, E., Ofojekwu, P. C. and Nweke, I. E. (1992). A survey of helminth parasites of *Clarias gariepinus* in Plateau state, Nigeria. *Journal of Aquatic Sciences 7*: 39 – 43.

Awachie, J. B. E. (1966). Preliminary notes on the parasites of fish in the area of the Kainji reservoir. In the first scientific report of the Kainji Biological Research Team, U.K. *1*: 65 – 69.

Auta, J., Oniye, S. J. and Adakole, J. A. (1999). The helminth parasites of the gastrointestinal tract of *Synodontis* species in Zaria, Nigeria. *Journal of Pure and Applied Sciences* 2(2): 47 – 53.

Banyighi, H. A., Oniye, S. J., Balogun, J. K. and Auta, J. (2001). Feed utilization and growth of juvenile catfish (*Clarias gariepinus*) fed heat treated Bambara groundnut [*Vigna subteranea* Verde, (L)] meal. *Journal of Tropical Biosciences, 1*(1): 55 – 61.

Basu, M., Miringa, I. M. and Yusuf, S. D. (1993). A comparative study of the incidence and intensity of intestinal helminth parasites of *Clarias* species in Lakes Alau and Kwanda, Borno State. *Annals of Borno 10*: 188 – 195.

Buchmann, K. and Lindenstrom, T, (2002). Interactions between monogenean parasites and their fish hosts. *International Journal of Parasitology 32*: 309 – 319.

Cheng, T. (1973). *General Parasitology*. Academic Press, New York, USA. 965 pp.

Eyo, A. A. and Olatunde, A. A. (2001). Protein and amino acid requirements of fish with particular reference to species cultured in Nigeria. In: *Fish Nutrition and Fish Feed Technology* (A. A. Eyo, ed.). Fisheries Society of Nigeria (FISON) Lagos, Nigeria. 58 – 71 pp.

Faturoti, E. O., Balogun, A. M. and Ogwu, L. L. C. (1986). Nutrient utilization and growth responses of *Clarias lazera* fed different dietary protein levels. *Nigerian Journal of Applied Fisheries and Hydrobiology 1*: 41 – 45.

Geets, A. and Ollivier, F. (1996). Endoparasitic helminths of the white spotted rabbit fish (*Siganus sutor* (Valenciennes) 1935) of the Kenyan coast: Distribution within the host population and microhabitat use. *Belgian Journal of Zoology 126*(1): 21 – 36.

Ikomi, R. B. and Odum, O. (1998). Studies on aspects of the ecology of the catfish, Crysichthys *auratus* Geoffrey St. Hilaire (Osteichthyes; Bagridae) in the River Benin (Niger Delta Nigeria), *Fisheries Research 35:* 209 – 218.

Jeje, Y. C. (1992). Post larval feeding of *Clarias gariepinus* Burchell, (1802) on cultured zooplankton and artemia diets. Proceedings of the 10th Annual Conference of the Fisheries Society of Nigeria (FISON), Abeokuta, Nigeria. 16-25 Nov. 129 – 135 pp.

Lees and Bass (1960). Sex hormone as a possible factor influencing the level of parasitisation in

frogs. *Nature 188*: 1207 - 1208.

Margolis, L., Esch, G. W., Holmes, J. C., Kuris, A. M. and Scad, G. A. (1982). The use of ecological terms in parasitology (Report of an Ad-hoc committee of the American Society of parasitology). *Journal of Parasitology 68*(1): 131 – 133.

Markevich, A. P. (1963). Parasitic fauna of fresh water fish of the Ukranian. Israel program for Scientific Translation Ltd. IPST cat. No. 844, 388 pp.

Onwuliri, C. O. E. and Mgbemena, M. O. (1987). The parasitic fauna of some fresh water fish from Jos Plateau, Nigeria, *Nigerian Journal of Applied Fisheries and Hydrobiology* 2: 33 – 37.

Onyia, A. D. (1970). Notes on some parasites of freshwater fishes of Lake Chad. Annual Report of Federal Department of Fisheries, Lagos, Nigeria. 39 – 45 pp.

Ovie, S. I. and Ovie, S. O. (2002). Fish larval rearing: the effect of pure/ mixed zooplankton and artificial diet on the growth and survival of *Clarias anguillaris* (Linnaeus, 1758) larvae. *Journal of Aquatic Sciences 17*(1): 67 – 73.

Paperna, I. (1980). Parasites, infections and diseases of fish in Africa, CIFA Tech. Paper, 7, FAO, Rome, Italy. 200 pp.

Paperna, I. (1996). Parasites, infections and diseases of fish in Africa- An update, CIFA Tech. Paper, 31, FAO, Rome, Italy. 200 pp.

Petrochenko, V. I. (1971). Acanthocephala of domestic and wild animals. Israel program for Scientific Translation Ltd. IPST Cat. No. 5901.

Reed, W., Buchard, J., Hopson, A. J., Jennes, J. and Yaro, I. (1967). Fish and Fisheries of Northern Nigeria. Gaskiya Corporation, Zaria, Nigeria. 226 pp.

Soulsby, E. L. J. (1982). *Helminths, Arthropods and Protozoans of Domesticated Animals*. 7th Edition. Bailliere Tindall, London, UK. 809 pp.

Subashinghe, R. (1995). Diseases control and health management in aquaculture. *FAO* Aquaculture *Newsletter 9*: 8 – 11.

Tesch, F. W. (1968). Age and Growth, In Methods for assessment of fish production in freshwaters (W. E. Ricker, ed.) Blackwell Scientific Publications, Oxford, UK. 93 – 123 pp.

Ugwuzor, G. N. (1987). A survey of helminth parasites of fish in Imo River. *Nigerian Journal of Applied Fisheries and Hydrobiology 2*: 25 – 30.

Umoren, N. A., Onwuliri, C. O. E. and Anadu, D. I. (1988). Comparative studies on endohelminth parasites of cultured and uncultured fish from Plateau State, Nigeria. *Nigerian Journal of Applied Fisheries and Hydrobiology 3*: 45 – 48.

Viveen, W. J. A. R., Richter, C. J. J., Oordt, van P. G. W. J., Janssen, J. A. L. and Huisman, E. A. (1977). Practical manual for the culture of the African catfish (*Clarias gariepinus*). International Cooperation of the Ministry of Foreign Affairs, Netherlands. Department of Fish Culture and Fisheries of the Agricultural University of Wageningen, Netherlands and Comparative Endocrinology, Department of Zoology of the University of Utrecht, the Netherlands. 94 pp.

Williams, H. and Jones, A. (1994). *Parasitic Worms of Fish*, Taylor and Francis, Bristol, UK. 593 pp.

Yamaguti, S. (1959). *Systema helminthum*, Volume II. The Cestodes of vertebrates. Interscience Publishers, Inc., New York, USA. 860 pp.

Yamaguti, S. (1961). *Systema helminthum,* Nematodes of Vertebrates. Interscience Publishers, Inc., New York, USA 1261 pp.

Received: 15 March 2004; Accepted: 11 June 20