



Helminthes Parasites of *Clarias gariepinus* in Abraka Delta State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Authors JOO and AOE designed the study. Author SSE performed the statistical analysis. Author JOO wrote the protocol and wrote the first draft of the manuscript. Authors JOO and SSE managed the analyses of the study. Author JOO managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Fish is significant as a vector of disease pathogen of human and animals. The study of the helminthes parasites of *Clarias gariepinus* in Abraka was carried out to investigate the occurrence, prevalence and intensity of helminthes parasites in *Clarias gariepinus*; and to compare the helminthes parasites burden of the wild and cultured *Clarias gariepinus* in Abraka fresh water. A total number of four hundred and nine (409) *Clarias gariepinus* were examined. Collection of fish samples was done monthly for twelve months. The external parts of each fish were examined with a hand lens for the occurrence of helminthes parasites. Portions of the muscles were also teased apart in saline water and examined under the microscope first at x 40 and later x 100 oil immersion. Organs of the body were examined separately in petri dishes containing normal saline. The different groups of parasites recovered were preserved in formaldehyde and identified using prescribed methods. Of the 409 *C. gariepinus* examined, 172 were infected, showing an infection rate of 42.1%. *C. gariepinus* from the wild had a higher prevalence of 31.1% while those from culture ponds had a lower prevalence of 11%. A total of 485 parasites were recovered, comprising of 113 trematodes and 372 nematodes which represents 23.3% and 76.7% respectively. Identified

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trematodes included *Diplosomum sp.*, *Macrogyrodactylus sp.*, and *Quadriancanthus sp.*, while nematodes included *Procamallanus sp.* and an Ascarid nematode. The highest intensity of infection of 3.11 was recorded in the Ascarid nematode while the least of 1.25 came from *Diplosomum sp.* in *C. gariepinus* caught from the wild. Although, there appears to be a lack of reported cases of the occurrence of the ascarid nematode that was recovered from the muscles of *C. gariepinus* in literature, it is evident from this study that it is a common endoparasite of the African catfish in Abraka freshwater.

Keywords: *Helminthes parasites; Clarias gariepinus; Abraka.*

1. INTRODUCTION

Over the years, the role of fish as food and tenderness in the diet of humans has been patronized. This is because fish is a rich of easily digestible and absorbable animal protein, an inevitable food substance for growth and repair of worn out body tissues. Fish is also a reasonable source of carbohydrates, lipids, vitamins and minerals. This is why fishing and fish culturing have for long time a source of employment and income to many people worldwide. There has been an increasing interest in aquaculture, aquaculture industry and wild life fisheries, not only as part of the efforts to meet the protein demand of the every increasing population of the world, but also for recreation and pleasure as derived from fish sporting. In addition, knowledge is acquired from scientific researches with fish while some fish feed on water dwelling insect larvae and pupae, thereby, helping to control some disease vectors.

The tropical climate appears to favour breeding and thriving of many fish species in the aquatic habitat. In Nigeria, this is exemplified by the presence of abundant fish species in the water bodies especially in the Niger Delta region. This is why many people in this region earn their living either through subsistence wild life fishing or by commercial fish culturing in aquacultures.

The Niger Delta of Nigeria particularly harbours several species of fish but catfish also known, as *Clarias* appears to be one of the most abundant. Reed et al. [1] denoted to this when he reported that the sharp tooth catfish, *C. gariepinus* was probably the most widely distributed fish species in Africa. According to Reed et al. [1], the economic importance of this fish species has increased greatly in recent years as a result of its extensive use in aquaculture.

However, fish is also significant as a carrier of disease pathogen of human and other vertebrates [1]. Parasitism in fisheries and aquaculture is becoming a global concern.

Parasites could constitute nuisance by causing disease to the host fish and may be transmitted to other like humans that feed on the infected fish [2]. Even if these parasites do not cause death directly, they tend to lower the general health condition of the fish (immunosuppressive), making them susceptible to other more dangerous pathogens.

Knowledge about the parasites of fish has accumulated in many parts of the world but such comparative studies in Africa has been sporadic [3]. Some reports of parasites of freshwater fish in Nigeria include Okaka and Omoigberale [4], Ibiwoye et al. [2], Nmor et al. [5] and Abdel Gaber et al. [6]. Most of, these reports were not on helminthes parasites of *Clarias gariepinus* in Abraka.

Finally, the population of Abraka is growing very fast. The food, health care and academic needs are equally increasing significantly. Local sources of fresh water fish are the Ethiopie river, lower Warri river, local fish ponds and aquacultures. A study of the parasites of fish in Abraka will be a vital contribution to knowledge, hence, this study was undertaken to investigate the occurrence, prevalence and intensity of helminth parasites in *Clarias gariepinus*; and to compare the helminth parasites burden of the wild and cultured *Clarias gariepinus* in Abraka fresh water.

2. MATERIALS AND METHODS

2.1 The Study Area

Abraka is a fast growing university community in Ethiopie East Local Government Area of Delta State, Nigeria. The aquatic habitats in Abraka from which fish is collected for consumption comprise mainly of the Ethiopie river, the lower Warri river, which flows through Abraka inland (Otorho-Abraka), local fish ponds and aquacultures situated in and near the town.

The Ethiope River takes its source at Umuaja and flows from the east to south through major towns like Umutu, Obiaruku, Abraka, Eku, Aghalokpe to Sapele, all in Delta State; with an entire length of about 100km. The lower Warri River takes its source from Utagba Unor and flows for 74 km through Abraka-Inland (Otorho-Abraka), Ovu, Oorerokpe, Agbarho, Otokutu, Warri and finally into forcados estuary where it joins the Atlantic Ocean. Both rivers are freshwater habitats flowing through dense rainforest and farmlands where surface run-off and organic matter from the surrounding vegetation contribute to debris input. They also receive storm water run-off from bordering agricultural lands as well as rural and urban areas. Human activities in the rivers include

fishing, washing and bathing. They also facilitate the transport of goods and people with canoes.

2.2 Collection and Preparation of Fish for Examination

Collection of fish samples for examination was done monthly between September, 2017 and August, 2018. On every sampling day, *Clarias gariepinus* from the rivers and local ponds were caught using various fishing gears like fishing baskets, funnel entrance traps and sieve nets with the help of fishermen. On the other hand, cultured *C. gariepinus* were purchased from fish aquaculture ponds in Abraka. The fish from the wild and culture were transported to the laboratory in two separate plastic containers.

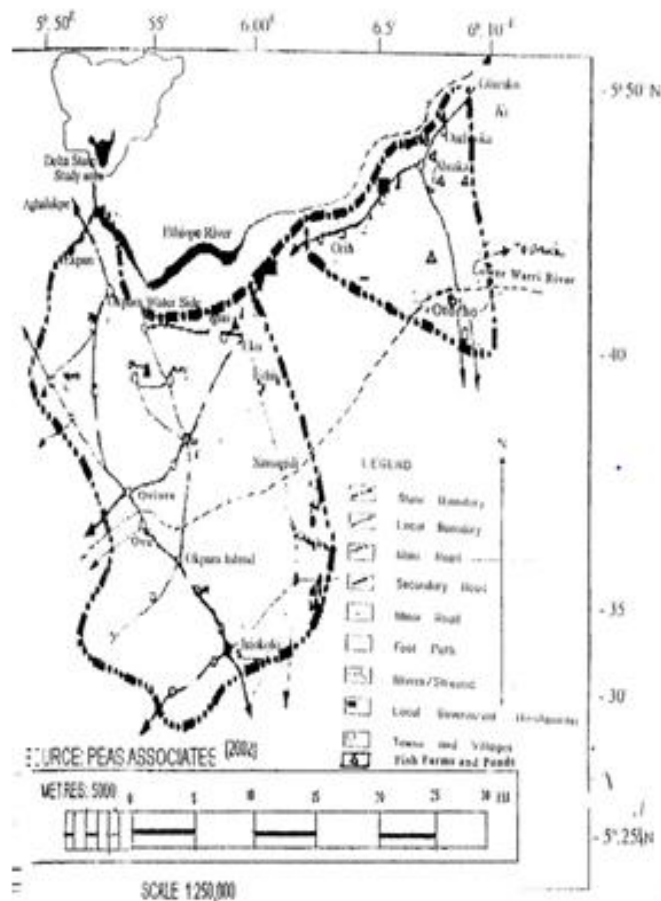


Fig.1: Map of Ethiope East Local Government Area showing the various Towns including Abraka and Study Locations.

Fig. 1. Map of Ethiope East local government area showing the various towns including Abraka and study location

Those fishes that died during transportation of samples were preserved in 10% formalin but were immediately examined on arrival at the laboratory. The live fish were anaesthetized using tricaine methone sulphanate (MSS 222) before examination. The fish were identified as *C. gariepinus* with the aid of identification keys as described by Boulenger [7], Daget and Litis (1965), Lowe-McConnell [8] and Holden and Ree [9].

The weight of each fish was obtained and the sex determined, using mainly the matured gonads and some external morphology like head regions and fins.

2.3 Examination of Fish for Ectoparasites

The external parts such as skin and fins of each fish were examined with a hand lens for the occurrence of helminthes parasites. A smear scraping was then taken from the skin of each fish. The fins were also cut in bits, mounted on a slide in water and examined in detail. This was followed by microscopic examination of the bucal and opercula cavities. Gills were removed and examined with hand lens, first for the occurrence of helminthes parasites. They were then placed in petri dishes containing normal saline, cut into bits and examined in details under the microscope.

A total of four hundred and nine (409) *C. gariepinus* were observed. Of this number, two hundred and forty three (243) were obtained from the wild while one hundred and sixty six (166) were obtained from aquacultures in Abraka.

2.4 Examination of Fish for Endoparasites

Each fish specimen was first killed and then deep transverse cuts, about 0.5cm apart, were made into the muscles beginning from the abdominal region, through the trunk to the tail muscles using a sharp scalpel. Each cut was carefully examined for the presence of helminthes parasites. Portions of the muscles were also teased apart in saline water and examined under the microscope.

Eyes, brain and the viscera (liver, heart, gut, swim bladder, gonads and kidneys) were examined separately in petri dishes containing normal saline. The various tissues were teased apart in normal saline and examined in details for endoparasites under the microscope.

The gastro intestinal tracts were cut open and the content emptied into petri dishes containing tap water. These were examined under microscope. The dissected abdominal cavity was also examined for free or unattached parasites. The parasites recovered were further examined microscopically before being fixed in 70% alcohol. The number of parasites recovered per fish and their locations were recorded.

2.5 Preparation and Identification of Parasites

The trematodes were prepared as whole mounts using standard histological techniques for haematoxylin and eosin and carmine stains as recorded in Okaka [10]. The stained parasites were washed in 1% acid alcohol. Thereafter they were dehydrated in increasing concentration of alcohol 50%, 70%, 90% and absolute. The nematodes were also washed free of preservatives. Lactophenol was used to clear the parasites before viewing under the microscope as stated in Okaka [10]. Xylene was used to clear the parasite before mounting. Drawing of the parasites to scale was done using appropriate keys as described by Yamaguti [11]. The parasites were sorted out into their various groups and identified to at least the generic level where possible. The male *Clarias gariepinus* were easily distinguished from the female by presence of sexual papilla located behind the anus in male but absent in the female, Akinsanya and Otubanjo [12].

2.6 Statistical Analysis

Chi-square test was used to determine whether there is significant difference in the distribution of helminthes parasites between male and female fish.

3. RESULTS

3.1 Occurrence, Prevalence and Intensity of Infections

The general prevalence of helminthes parasites in *C. gariepinus* with mean length of 21.3 cm and mean weight of 72.39 g in Abraka freshwater is represented in Table 1. The overall pattern of infection shows that out of the 409 *C. gariepinus* examined, 172 fish representing 42.1% were infected.

Table 2 shows the helminthes parasite burden, that is, the intensity of infection among *C. gariepinus* examined. A total of 113 trematodes, giving an intensity of 1.82 were recovered from 62 fish while a total of 372 nematodes, with an intensity of 2.68 were recovered from 139 fish.

3.2 Helminth Parasites Recovered

Table 3 shows the helminthes parasites encountered and their percentage prevalence respectively. Five different species of helminthes parasites were recovered from *Clarias gariepinus*, from the wild while three different species were recovered from cultured *Clarias gariepinus*. Among fish from the wild, an ascarid nematode had the highest percentage prevalence of 20.1 while *Quadriacanthus* sp had the least of 2.7. Among cultured *Clarias gariepinus*, ascarid nematode also had the highest percentage prevalence of 9.1 while *Procamallanus* sp. had the least of 2.0.

Table 4 shows the parasites recovered their location in the body of the fish and their prevalence in the overall fish examined. A total of 61 *C. gariepinus* representing 14.9% were infected with parasites of the class Trematoda while 156 fish (38.1%) were infected with parasites of the class Nematoda.

3.3 Infection According to Sex

Table 5 shows the sex related prevalence of helminthes parasites among *Clarias gariepinus*. Out of the 243 fish from the wild, 59, males representing 24.3% were infected while of the 166 cultured fish examined, only 21 males that is, 12.7% were infected. Also, 68 female fish from the wild, (27.9%) were infected while 24 cultured females representing 14.5% were infected. The overall figures show that 80 (19.6%) males were infected out of the 409 examined fish while 92 (22.5%) females were infected.

4. DISCUSSION

The result of this study shows that 42.1% of *Clarias gariepinus* collected harboured at least a helminthes parasite. The overall infection rate of 42.1% observed in this survey is not at variance with previous reports of 43.6% infection of fish in two lakes and a river in Zaria [13] and 42.4% in Bide flood plain [2]. However a much higher infection rate of 89.3% was recorded at Borno lake in Borno by Aken'ova [14], 51% at Okuaihe river, Edo state by Okaka and Omoigberale [4] and 60.6% at the upper reaches of Orogodo River, Delta state by Nmor, et al. (2004). Contrary to this, a lower prevalence of infection was reported by Okaka [15] with an infection rate of between 18.6% and 28.6% in Osio and Benin rivers respectively while Okaka and Akhigbe [16] recorded 17.1% in Osse River in Benin. Also Paperna [17] recorded an overall prevalence of 24% and 26% of *Dolops ranarum* in *Clarias gariepinus* and *D. mossambians* respectively in surveyed impoundment in Transvaal, South Africa.

These results show that prevalence of infections vary from one locality to another and season to season, depending on the fish species and the parasite in question. Kruger et al. [18] and Shafir and Van As [19] alluded to this claim when they reported that extremely heavy infection of *Argulus japonicas* occurred in *Clarias gariepinus* trapped in dams restricted (and stressed) by the low ambient temperature (8-13^oc) in Southern Africa. Umoeren et al. [20] also noted that there was a variation of infection rate between localities when they studied endohelminth parasites of cultured and uncultured fish from Plateau State. This was also evident in the present study where an overall prevalence rate of 31.1% was recorded in *C. gariepinus* from the wild but only 11.0% in cultured fish.

Table 1. General prevalence of Helminth parasites in *Clarias gariepinus* from Abraka freshwater

Host	No examined	No infected	Percentage prevalence (%)
<i>Clarias gariepinus</i> from the wild	243	127	31.1
Cultured <i>Clarias gariepinus</i>	166	45	11.0
Total	409	172	42.1

Table 2. Intensity of infection of helminth parasites (parasites burden) among *Clarias gariepinus* from abraha freshwater

	Nematode			Trematode			Overall
	No infected	No of Parasites	Intensity of Infestation	No infected	No of Parasites	Intensity of Infestation	
<i>C. gariepinus</i> From the wild	46	78	1.70	101	301	2.98	2.58
Cultured <i>C. gariepinus</i>	16	35	2.19	38	71	1.87	1.96
Total	62	113	1.82	139	372	2.68	

Table 3. Species of helminthes parasites encountered, their percentage/prevalence and intensity respectively

Host	Names (Species)	Class of parasite	No of fish parasite	Prevalence Infected	No. of Parasite	Intensity of Parasites
<i>C. gariepinus</i> from the wild	Ascarid nematode	Nematoda	80	20.1	25	3.11
	<i>Diplostomum sp.</i>	Trematoda	16	3.9	20	1.25
	<i>Procamalanus sp.</i>	Nematoda	29	7.1	46	1.59
	<i>Macrogryrodactylus sp</i>	Trematoda	18	4.4	43	2.39
	<i>Quandriacanthus sp.</i>	Trematoda	11	2.7	15	1.36
Cultured <i>C. gariepinus</i>	Ascarid nematode	Nematode	37	9.1	49	1.32
	<i>Procamalanus sp.</i>	Nematode	8	2.0	22	2.7
	<i>Macrogryrodactylus sp.</i>	Trematoda	16	3.9	35	2.19

Table 4. Location of Helminthes parasites Recovered and their Prevalence in the overall fish examined

Parasites	Location in Fish	No of fish infected (%)
Trematodes		
<i>Macrogyrodactylus sp.</i>	Gills	34 (8.3)
<i>Quandriacanthus sp.</i>	Gills	11 (2.7)
<i>Diplostomum sp.</i>	Brain	16 (3.9)
Total		61 (14.9)
Nematodes		
Ascarid nematode	Muscles	119 (29.1)
<i>Procamallanus sp.</i>	Intestine	37 (38.1)
Total		156 (38.7)

Table 5. Sex related prevalence of Helminth parasites among *Clarias gariepinus* from Abraka freshwater

Host	No examined	Males infected (%)	Females infected (%)	Total (%)
<i>Clarias gariepinus</i> from the wild	243	59 (46.46)	68 (53.54)	127 (73.84)
Cultured <i>Clarias gariepinus</i>	166	21 (46.67)	24 (53.33)	45 (26.16)
Total	409	80 (46.51)	92 (53.49)	172 (42.05)

Several factors appear to influence the general prevalence and distribution of parasites in their fish hosts. Such factors include host susceptibility [2], availability of intermediate host [21] as well as feed and food source due to contamination of water habitat [22]. Other factors that tend to affect parasite distribution include host availability, host characteristics (such as health condition, age, sex and behavioural pattern). The habitat determines the productivity of zoo- and phytoplankton community as well as the flora and fauna population. The speed of flow of water tends to influence the parasite community in the habitat. For instance parasite build-up, will be higher in stagnant or slow running freshwater than that which is fast running [23]. In the present study however, a higher prevalence was recorded in fish from the wild than those in culture.

Most of the parasites recorded in this study have been reported previously in other parts of Africa such as Egypt, East Africa, Ghana, South Africa, Sudan and Uganda [17]. Previous reports of these parasites in Nigeria include Aken'ova [13,14]. Awharitoma and Okaka [24], Alumma and Idowu [25], Enyidi and Eneje [26] and Okoye et al. [27].

The trematodes encountered were *Diplostomum sp.*, *Macrogyrodactylus sp.* and *Quandriacanthus sp.* while the nematodes were an ascarid

nematode and *Procamallanus sp.* The parasites recovered and their prevalence in the overall fish examined showed that the ascarid nematode recovered from the muscles of *Clarias gariepinus* had the highest infection rate of 29.1% while a trematode *Quandriacanthus sp.* recovered from the gills had the lowest infestation rate of 2.7%. It is not yet understood how the ascarid nematode got to the muscles of the fish. Although, there appears to be a dearth of reported cases of the occurrence of this ascarid nematode that was recovered from the muscles of *C. gariepinus* in literature, it is evident from this study that it is a common endoparasite of the African catfish in Abraka freshwater. The other nematode, *Procamallanus sp.* recovered from the intestine had been reported in West Africa, the Chad Basin and the lakes of East Africa [22]. In Nigeria, the occurrence of *Procamallanus sp.* in the intestine of several species of fish had been reported by Okaka [15], Okaka and Akhigbe [16] and Okaka and Omoigberale [4]. As an intestinal nematode, the route of infection of *Procamallanus sp.* may be through the mouth, that is, by swallowing of eggs or/and larvae (infectious stages) along with food or by taking in intermediate host of the parasite that contaminate food.

Two of the three trematodes encountered in this survey, *Macrogyrodactylus sp.* and *Quandriacanthus sp.* were recovered from gills.

The infection of *Clarias* by ectoparasites had earlier been reported. For instance Obiekezie and Taeye [28] reported severe mortalities of *C. gariepinus* fry in a hatchery in Nigeria due to severe infestation by *Gyrodactylus groschafti*. Paperna [29] also reported that species of *Macrogyrodactylus* occurred in fish with potential for aquaculture in African *Clarias* sp, *Lates niloticus* and Anabantidae. Similarly, Aken'ova [14] reported the occurrence of *Macrogyrodactylus congolensis*, *Quadriacanthus* sp and *Clinostomoides breni* in the gills of *Clarias* spp. in Zaria. Preference for the gills by these ectoparasites may be due to the rich supply of blood. The third trematode encountered in this survey *Diplostomum* sp. was recovered from the brain of the fish. Previous reports of this parasite in Nigerian freshwater fish include Ogbe et al. [30], Okaka and Akhigbe [16], and Amos et al. [31]. Some reported cases other African countries are [17] in Uganda, Moravec and Jirku [32] in central Africa.

In this study, sex related prevalence of infection was only slightly higher in females (22.5%) than males (19.6%). This conforms to reports by Mhaisen et al. [33] and Ibiyowe et al. [2] that female fish were more frequently infected with parasites than males.

The relative parasites burden is higher in fish from the wild (2.58) than those from culture (1.96). This difference is high and may have been occasioned by the high nematode parasitic load of fish from the wild with an intensity of 2.98 while those of culture have nematode intensity of only 1.89. The overall trematode burden is lower (1.82) than that of nematode (2.68). The relative intensity of *Procamallanus* sp. is higher (2.75) in cultured fish than in the wild fish (1.59) the reason may be attributed to faster distribution of parasites in confinement (such as aquaculture) than the wild as suggested by Umoeren et al. [20]. This is because the presence of a large population of a particular species of fish provides ample habitat for parasites. The stress conditions associated with such crowding also affect the health, thereby increasing the susceptibility of the fish to parasitic infection [34].

The effects of these parasites on the fish could not be immediately ascertained in this study. However, it was observed that the sizes of fish obtained from the wild were generally smaller than those obtained from culture. Although several other reasons may be adduced for this, it is reasonable to adduce that it may be due to the

higher prevalence of infection and higher parasite burden in *C. gariepinus* in the wild than those in culture. Some of the fish that were heavily infected had greyish patches on their skin that made them to appear pale. Heavy infestation generally compromises host ability to withstand stressful conditions. Adult worm and trapped eggs can also physically obstruct the passage of blood causing thrombosis and subsequent necrosis [35], while escape of miracidia through the gill epithelium can cause loss of blood and may lead to anaemia.

Although the possible pathological effect of the parasites of *C. gariepinus* on humans and domesticated animals was not considered in this study, it could be speculated that the infection of fish by parasites does not portend well for the fish industry, domesticated animals and humans. This is because apart from affecting the productivity of fish through mortalities, reducing growth and reducing the quality of the meat, fish parasites cause economic loss to fish farmers and loss of protein sources [34]. Fish have been shown to act as intermediate host of parasites. Parasites can also be transmitted to man or other animals if they eat raw or insufficiently cooked fish. For instance, Lim [34] reported four trematodes (*Clonorchis*, *Ophisthorcis*, *Heterophis* and *Metagonimus* sp) and two nematodes (*Gnathosoma* sp. and *Capillaria philippinensis*) in Southeast Asia, which can be transmitted to man via eating of raw or insufficiently cooked fish.

In view of the finding of this survey, it is recommended that further investigation be carried out on the biology of helminthes parasites of fish in Nigeria freshwater. This is in order to have better understanding of their life cycle, mode of infection, pathology and control. This will no doubts go a long way to improve the condition of fish and make fish farming more profitable.

5. CONCLUSION

The occurrence of parasites in this study leads to the conclusion that the source of fish is an important determinant of the distribution and occurrence of parasites. Therefore, it is recommended that: Thorough screening and sanitary control of fishes from wild is necessary before restocking activities. Also education about proper preparation of fish is a proper preventive measure. Considering the prevalence sites, a proper cooking and degutting of fish is highly recommended to avoid zoonotic disease.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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