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Survey of parasites of two fish species (*Tilapia zillii* and *Clarias gariepinus*) in Ase River Catchment, Delta State, Nigeria

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ABSTRACT

Objective: To perform a survey of parasites of two fish species [*Tilapia zillii* (*T. zillii*) and *Clarias gariepinus* (*C. gariepinus*)] to assess the prevalence and composition of parasites in Ase River catchment, Delta State, Nigeria.

Methods: Fish samples were collected from three sampling stations and examined for ecto- and endoparasite. Of 180 specimens examined, 60 were from each station comprising 30 *C. gariepinus* and 30 *T. zillii*.

Results: Station 1 had the highest percentage abundance followed by stations 3 and 2, each with a value of 40.86%, 33.33% and 25.81%, respectively. Ninety (90) specimens composed of 47 males (26.11%) and 43 females (23.89%) were infected. Of these, 21 (23.33%) were male in *T. zillii* while 25 (27.78%) were female. Male *C. gariepinus* were more infected than the female with a prevalence of 28.88% and 20.00%, respectively. A total of 8 parasites belonging to 4 taxonomic groups were identified. They include the protozoa represented by *Trichodina acuta* 29 (31.18%), *Epistylis* spp. 11 (11.83%), *Chilodonella* spp. 8 (8.60%), and *Ichthyophthirius multifiliis* 2 (2.15%); Nematode: *Camallanus polypteri* 38 (40.86%) and *Procamallanus spiralis* 2 (2.15%); Trematode: *Euclinostomum heterostomum* 1 (1.07%) and lastly the acanthocephalan represented by *Acanthogyryus tilapiae* 2 (2.15%). Total prevalence of infection was 50.0% for both species, with an overall prevalence of 51.11% (46) in *T. zillii* and 48.89% (44) in *C. gariepinus*. ANOVA showed that there was a statistical significant difference ($P < 0.05$) in the infection in the three stations. However student *t*-test showed no significant difference between sexes of both species.

Conclusions: The prevalence of parasites recovered from the two fish species in this study is high. It is therefore recommended that the riparian communities along the river course should desist from activities likely to increase parasite load with restriction of cattle alongside egrets which are the definitive host of *Euclinostomum heterostomum*.

1. Introduction

Tropical freshwater fishes such as *Tilapia zillii* (*T. zillii*) and *Clarias gariepinus* (*C. gariepinus*) serve as definitive/transport or intermediate host in the developmental cycle of many species of protozoan, metazoan and crustacean parasites[1]. Parasites are invertebrate organisms; some are free-living and can become opportunistic parasites while the obligate parasites require hosts for their survival and reproduction. Both opportunistic and obligate parasites are found in fish hosts but most parasitic diseases in fish

are generally caused by obligate parasites[2].

In fisheries, some parasites may be highly pathogenic and contribute to high fish mortalities and economic losses or threaten the abundance and diversity of indigenous fish species[3,4]. *T. zillii* and *C. gariepinus* are the most common sources of protein for humans and other animals in the tropics[5-7]. Fish interacts with the various levels of food chain and influences the structures of rivers, lakes, streams and estuaries, since they are usually restricted to particular modes of life related to their food sources and reproductive requirements[8,9].

Like other animals, fish is also afflicted by endo- and ectoparasites, especially protozoans and helminths causing heavy mortality[10]. Fish parasites and diseases constitute one of the most important problems confronting fish farmers today[11]. Pathological conditions resulting from parasites and diseases cause high magnitude of epidemics under crowded and other unnatural conditions[12]. The role of freshwater fish in transmitting parasites

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to humans had been known for a long time[2,13]. Zoonotic diseases that result from the ingestion of raw or undercooked fish include opisthorchiasis, diphyllorhynchiasis, clonorchiasis, gnathosomiasis, helminthiasis and anisakiasis[14].

In recent times, attention has shifted to fish parasites due to increased aquacultural practices. Awareness of fish parasites have been established both in cultured and wild fish[15-17]. Preliminary reports of fish parasite from Orogodo River[18], Owa Stream[19] and Eleyele Dam[20] and many other freshwaters have been documented in Nigeria. The consequences of the parasitic infections on fish cannot be overemphasized. Undoubtedly, acute parasitic infection in fish induces severe body deformities and increases mortality rate of fish species in fish communities. Consequently, this therefore leads to a reduction in the quantity and quality of fish available for human use. Thus, there is a need to provide information on the composition of parasites infecting fishes in Ase River. The objective of the present study is aimed at investigating the prevalence of parasites of *T. zillii* and *C. gariepinus* found in the down reaches of Ase River and to provide information on the distribution of parasites capable of inducing disease condition of fishes found in the river catchment.

2. Materials and methods

2.1. Description of study area and sample location

The Ase River is one of several rivers that drain the recent delta top land forms of the Western Niger Delta and it is a coalescing of several tributaries that arise from the southern and southwestern slopes of the Asaba Plateau. These tributary rivers include the Oboshi River and the Atakpo Creek that respectively flank Ibusa sub urban community on the west and east; the Nooni River which is west of Ogwashi Uku and flows past Nsukwa and the Adofi River with headwater tributaries at Ejeme Aniogor and Agbor Aladinma. The tributaries meet just south of Iselegwu to form the main trunk of Ase River. The river thereafter shares a flood plain with the River Niger and flows southwards alongside it to join the Nikeroga River, the western branch of the two rivers into which the River Niger splits, the other and eastern branch being the Nun River [personal communication with I.A Akpoborie (Professor of hydrology)]. The typical tropical climate of the area is governed by the northeastern and southwestern winds which generally influence the climate of Nigeria. The river flows through settlements such as Asaba-Ase, Ase, Ibredeni, Ivorogbo, Awah, Ibrede, Igbuku, Ashaka, Kwale, Umusedeli, Osemele, Obetimi-Uno, Iselegu, Obikwele among others. Fish samples were collected from three stations: station 1 (Asaba-ase: Latitude 5°18'24.0" N, Longitude 6°18'27.0" E); station 2 (Ibredeni: Latitude 5°23'58.8" N, Longitude 6°20'34.4" E) and station 3 (Ivrogbo: Latitude 5°25'07.4" N, Longitude 6°20'36.9" E) in the month April 2014 with the assistance of some fisher folk at the various villages in which the samples were collected.

2.2. Laboratory method

The laboratory methods include fish identification, sex

determination, parasite identification and preservation recommended by Uptom[21].

2.3. Fish identification

Fish catch of the river was identified and confirmed to generic and species levels where the standard taxonomic key of Olaosebikan and Raji[22] as well as Idodo-Umeh[23] was possibly used. The sexes of the fish were determined only after dissecting the fishes and noting the presence of testes or ovaries. Based on this, the fishes were sorted into males (those with testes) and females (those with ovaries).

2.4. Examination for parasites/parasite identification

The skin of *C. gariepinus* and the scale of *T. zillii* were examined for ectoparasites using a hand lens and later with a microscope. Then the slimy substance on the skin of *C. gariepinus* and the scale of *T. zillii* was removed and kept in a sterile container labelled for each station, followed by the addition of few quantity of saline solution. A little quantity of this mixed solution was dropped on microscopic slide covered with a cover slip and examined under light microscope at 40× magnification lens of a light microscope.

The fish were dissected and the alimentary canal, liver, kidney, swim bladder and spleen were sectioned for endoparasites examination. The excised gastrointestinal tract was carefully sectioned into portions such as oesophagus, intestine and rectum and each portion was then cut open, washed in Petri dish with 0.1% sodium chloride solution and further rinsed with 0.1% sodium bicarbonate to enhance parasite search. These were quickly stained with Giemsa and viewed at 40× and 100× magnification. The gills were carefully removed and kept in sterile container with little saline solution added to the sterile container. Later few drops of this solution was placed on a microscopic slide, covered with a cover slip and examined under the 40× magnification lens. The parasites recovered were identified and confirmed to generic and species levels where the key of Marcogliese[24] and Poudel *et al.*[25] was possibly used.

2.5. Preservation

The parasites recovered from the fish stomach and intestines were stored and preserved in vials containing 70% ethanol. Trematode cysts from the muscle were manually teased to release the metacercariae, which were fixed in hot alcohol-formal-acetate (AFA) and preserved in 70% ethyl alcohol as described by Ejere *et al.*[2].

2.6. Statistical analysis

Prevalence of parasites recovered was subjected to statistical analysis using Microsoft Excel 2003 package following the method of Okoye *et al.*[1]. The student *t*-test was used to determine the statistical difference at a significant level of 0.05.

The percentage prevalence was calculated using the formulae below:

$$\text{Percentage (\%)} \text{ prevalence} = \frac{\text{Number infected}}{\text{Number examined}} \times 100$$

Analysis of variance (5% level) was also used to test for significant difference in infection in each fish species in the three stations.

3. Results

A total of 180 fishes belonging to 2 families (Cichlidae and Clariidae), 2 genera and 2 species were examined for parasites. Out of the 180 fish examined, 90 (50.0%) were infected with ecto- and endoparasites. This study shows that *C. gariepinus* was the most infected with a prevalence of 60.00% in station 1. In station 2, there was equal prevalence of fish parasites between *C. gariepinus* and *T. zillii* (56.70%) followed by station 3 which had a prevalence of 30.00% in *C. gariepinus*. Further evaluation of the data revealed that the highest prevalence, 56.67% of parasite was recorded in station 2 compared to stations 1 and 3 which had a prevalence of 51.67% and 41.67% respectively.

The incidence of fish parasites in the fishes caught in the Ase River revealed that *T. zillii* had the highest overall incidence of parasite infection (51.11%) while *C. gariepinus* had the least 48.89%. However, analysis of variance (ANOVA) showed that there was a significant difference ($P < 0.05$) in the number of fish species infected in the three respective stations. Though student *t*-test showed no significant difference ($P > 0.05$) in the total number of fish infected.

Figure 1 depict the relationship between gender and prevalence of parasites in fish species. Of the 180 fishes examined, 47 males with a prevalence of 26.11% were infected while the female had 43 (23.89%) infection rate. The female *T. zillii* were more infected with a prevalence of 25 (27.78%) while the male had the least prevalence 21 (23.33%). However, in *C. gariepinus*, the prevalence trend was not similar. The male were more infected with a prevalence of 28.88% while the female were least infected with a prevalence of 20.00%. The overall prevalence in sexes showed that the males were more infected with a prevalence of 26.11% while the female were 23.89%. *T*-test analysis showed that the prevalence of the infection in male and female fish species examined were not statistically significant ($P > 0.05$) between the sexes in this study.

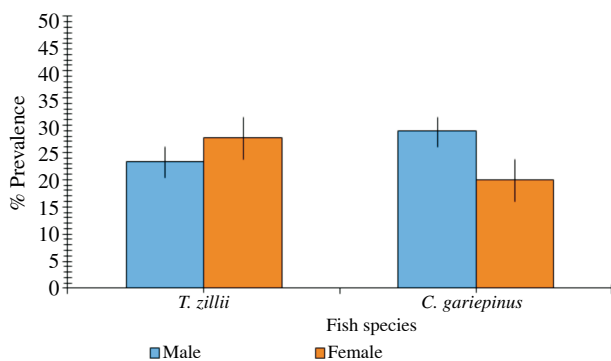


Figure 1. The relationship between sex related prevalence in fish species infected.

The relative abundance of ecto- and endoparasite recovered

in the study area are presented in Table 1. The Table shows that *Camallanus polypteri* (*C. polypteri*) 38 (40.86%) (Nematode), *Trichodina acuta* (*T. acuta*) 29 (31.18%) (Protozoa), *Epistylis* sp. 11 (11.83%), *Chilodonella* spp. 8 (8.60%) (Protozoa), *Acanthogyrus tilapiae* (*A. tilapiae*) 2 (2.15%) (Acanthocephala), *Procamallanus spiralis* (*P. spiralis*) 2 (2.15%) (Nematode), and *Euclinostomum heterostomum* (*E. heterostomum*) 1 (1.07%) (Trematode) were the parasite identified in this study (Table 1). Station 1 had the highest (40.86%) percentage abundance followed by station 3 and 2 with a relative abundance of parasites of 33.33% and 25.81%, respectively. However, station 3 had all the parasites isolated in this study. Analysis of variance (ANOVA) showed that there was a significant difference ($P < 0.05$) between the parasites found and no significant difference ($P > 0.05$) in the stations.

Table 1

Compositions and relative abundance of fish parasite (parasite load) recovered.

Parasite identified	Station 1 (Asaba-Ase)	Station 2 (Ibredeni)	Station 3 (Ivrogbo)	Total	% Abundance
<i>A. tilapiae</i>	1	-	1	2	2.15
<i>C. polypteri</i>	15	14	9	38	40.86
<i>Epistylis</i> species	4	4	3	11	11.83
<i>Chilodonella</i> species	2	-	6	8	8.60
<i>T. acuta</i>	15	6	8	29	31.18
<i>P. spiralis</i>	1	-	1	2	2.15
<i>E. heterostomum</i>	-	-	1	1	1.07
<i>Ichthyophthirius multifiliis</i>	-	-	2	2	2.15
Total	38	24	31	93	
% Abundance	40.86	25.81	33.33		

The total and highest number of parasitic load recorded in this study was found in the intestine with a parasitic load of 49 individual parasite, closely followed by the gill with 26 different parasites and lastly 18 parasites in the scale and skin of the fishes observed. The intestine was the main site of parasite occurrence in the fish as observed in the current study. The intestine recorded an overall infection rate of 49 (52.68%) as against the gills which had 26 (27.96%) and scale/skin 18 (19.35%) as shown in Table 2 and Figure 2.

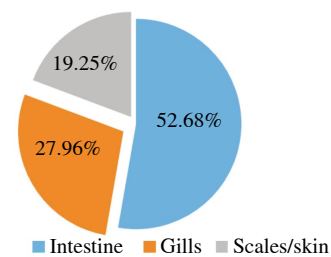


Figure 2. Organs observe with their corresponding infestation (%).

Table 2

Organs observe with their corresponding parasite burden and infestation (%).

Parasite identified	Scale/skin	Intestine	Gills
<i>A. tilapiae</i>	1	1	-
<i>C. polypteri</i>	3	25	10
<i>Epistylis</i> species	2	7	2
<i>Chilodonella</i> species	3	3	2
<i>T. acuta</i>	9	8	12
<i>P. spiralis</i>	-	2	-
<i>E. heterostomum</i>	-	1	-
<i>Ichthyophthirius multifiliis</i>	-	2	-
Total no. of parasites	18	49	26

4. Discussion

This research is the first of its kind to report the investigations of parasitofauna of two fish species in Ase River catchment. A total of 180 fishes belonging to 2 families (Cichlidae and Clariidae), 2 genera and 2 species were examined for parasites in Ase River. Out of the 180 fish examined, 90 (50.0%) were infected with ecto- and endoparasites while 90 (50.0%) fishes were not infected. The distribution of parasites in the gut of *T. zillii* and *C. gariepinus* showed that the majority of the parasites occurred in the intestine similar to finding of Aliyu and Solomon[3].

In general, the overall prevalence of 50.00% of parasites observed in this study is comparatively lower than the prevalence of 53.49% and 60.66% documented by Bichi and Ibrahim[26] and Nmor *et al.*[18]. Similarly, the prevalence values obtained in the current study is higher than 15.80%, 20.83%, 29.17% and 38.00% recorded by Oribhabor *et al.*[8], Bekele and Hussien[15], Edeh and Solomon[27], Biu and Akorede[5], respectively. This suggests that the occurrence of parasitism varies from one habitat to another and it could be due to host-parasite relationship and abiotic factors. However, the species composition of the parasites found in both fish species in this study are fewer than other studies[2,13,18]. The small number of the parasite composition isolated in this study could be due to the fact that the composition of fish parasite fauna is influenced more decisively by the fish species composition and the relatively small numbers of fish examined.

C. gariepinus are bottom dwellers/feeders, feeding primarily on detritus and benthic invertebrates. These invertebrates serve as intermediate hosts of various parasites which may develop into adults in the gut of fish after consumption especially if it is by a proper definite host[3]. Based on the number and type of nematodes parasite found in the fishes, it seems that the intermediate host Mesocyclops (a copepod)] in case of *Procamallanus* species are common in River Ase.

Simon-Oke[20] described *E. heterostomum* in the intestine of *T. zillii*, *Oreochromis niloticus* (*O. niloticus*) and *Sarotherodon galilaeus* in the Eleyele Dam, Western Nigeria. The adult trematode of *E. heterostomum* is attached to the upper and lower jaws of cattle egrets[28]. Purivirojkul and Sumontha[29] also showed that heavy infections of these trematodes occur in areas of large population of fish eating birds which act as definitive hosts. This could be the reason why the prevalence of *E. heterostomum* are present 1 (1.08%) because Fulani herdsmen occasionally graze their cattle on the nearby riparian vegetation and then lead them to the bank or the shallow parts of the river so that the cattle can drink water. These animals are usually accompanied by cattle egrets which act as the definitive host of the adult *E. heterostomum*. This trematode has also been reported in fishes from Owa Stream in Ijebu-Ode[19].

The Acanthocephalan, *A. tilapiae* which was found to parasitize *T. zillii* had been recorded in *O. niloticus* and *Clupisudis niloticus* in fish species from semi-arid reservoirs in Burkina Faso[17]. One of the earliest reports in Nigeria in inland waters concerning fish parasites was that of Awachie[30] who documented preliminary information on the parasites of fish in the Kainji reservoir. The Acanthocephalan found in *T. zillii* inhabits only the intestine of the Cichlids which

agrees with the findings of Awachie[30]. Other Acanthocephalans such as *Acanthogyrus* sp. and *Octospiniferoides* species have been recorded in the Cichlids of Orogodo River[18].

Two species of nematodes recorded in this study include *C. polypteri*, and *P. spiralis*. The *Camallanus* species have been recorded in the Cichlids of Orogodo River[18], while *P. spiralis* have been recorded by Edeh and Solomon[27] in *C. gariepinus* and *O. niloticus* in Utako. The intensity of *C. polypteri* was relatively high. There was affinity of nematode parasites to the intestinal region and this could result to mechanical pressure which may set up inflammation, cause the deformation of connective tissues and rupture of host tissues. It is important to note that due to these pathologic effects, the nutritive value of the fish may be degraded through the activities of these parasites.

The result revealed that the prevalence of parasitic infection in the male and female fish species of *C. gariepinus* and *T. zillii* examined were not statistically significant ($P > 0.05$). The male fish were more infected than the female with prevalence of 47 (26.11%) and 43 (23.89%) respectively compared with the report of Aloal[31] in Kenya. The differences in infection between the two sexes could be due to differential feeding either by quantity or quality of food eaten and as a result of different degrees of resistance to infection[5,32]. The observation of high prevalence of parasite in *C. gariepinus* in this study could also be due to the fact that there was simply more males available for infestation.

The parasites found in the fishes of Ase River may be deleterious to man as they may affect the survival, growth and development of fishes in the river. The fish species examined in this study could have suffered malnutrition due to parasitic infection since parasites contest with nutritious luminal content of its host. This condition may result to devaluation in protein content of the fish. Invariably, protein deficiency impairs normal metabolism of the liver, particularly man. Therefore, the infected fishes which may be zoonotic can transmit disease to man resulting to poor human health.

The prevalence of 90 (50.00%) of parasites recovered from the two fish species in this study is high. It is therefore necessary that the inhabitants of the riparian communities along the course of Ase River should desist from activities that are likely to increase the degree at which the fish species get infected with parasite. Some of these parasites especially the trematode parasites isolated are zoonotic capable of inflicting serious public health infections in man. In addition, the introduction of cattle by Fulani herdsmen which are accompanied by cattle egrets capable of transmitting trematode parasites to the fishes should be restricted. Consumers of fishes in form of barbeques from the river should ensure that the fishes are well cooked before eating to avoid human infection and reinfection.

Conflict of interest statement

I declare that I have no conflict of interest.

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