Research Article

Open Access

OCCURRENCE AND PREVALENCE OF PARASITES ASSOCIATED WITH *Gnathonemus senegalensis* IN APODU RESERVOIR, MALETE, NIGERIA

Oladipo S.O.*, Sunday O.J. & Ogunbiyi D.C.

Zoology Unit, Department of Bioscience and Biotechnology, Kwara State University, Malete, P.M.B. 1530, Ilorin, Kwara State, Nigeria.

Abstract

The prevalence of ecto- and endo-parasites of *Gnathonemus senegalensis* (Trunkfish) was determined with the view of quantifying the helminthic burden in Apodu reservoir, Malete. A total of 150 fish of *G. senegalensis* were caught with gill nets and cast nets between November 2017 and April, 2018. The fish were transported to the Parasitology laboratory, Kwara state University Malete, for parasite examination. The result shows a prevalence rate of 42% (n=150) with *Camallanus* sp. and *Capillaria* sp. having prevalence rates of 11.1 % and 60.32%, respectively. *Diphylobothrium latum*, *Acanthocephalan* sp., *Neascus* sp., *Tetrahymena* sp. and *Chilodonella* sp. had the prevalence rates of 46.03%, 20.63%, 30.16%, 19.05% and 20.63%, respectively. The ranges of physico-chemical parameters of the water body were: temperature (26.4 -26.9 °C); conductivity (66 – 83 µs/cm); pH (7.54 - 7.98); transparency (110 -402 cm); water current (0.04 -0.42 m/s) and total dissolved solids (34 – 44 ppm). The findings suggest that the observed parasitic infections may adversely affect the economic value of *G. senegalensis* and if not well managed, could also infect human beings who consume the fish.

Keywords: Apodu reservoir, *Gnathonemus senegalensis*, Malete, Parasite prevalence.

*Corresponding author: olayinka_sgn@yahoo.co.uk Received date: 23/07/2018, Accepted date: 04/01/2019

<https://orcid.org/0000-0001-7702-949>

This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License, which permits unrestricted use, distribution and reproduction in any medium provided the original author and source are credited.

1. Introduction

Gnathonemus senegalensis (Trunkfish) is recognized by the possession of upward pointing pectoral fins, narrow gill openings and a layer of muscle covering the opercula bone (Holden & Reed, 1972). They are normally caught in bottom nets, an indication that they are bottom feeders. These fish are generally classified as carnivores or predators feeding mainly on aquatic insects, smaller crustaceans and worms (Adebisi, 1978).

Transmission of parasites to humans through freshwater fish had been reported since fish parasites and diseases are very relevant issues confronting fishery biologists (Ravichandran *et al.*, 2007). Human activities and poor environmental conditions often subject fish to parasitic and other diseases (Biu *et al.*, 2014). Fish parasitic infestations are common in the tropics (Roberts & Janovy, 2009; Soliman & Nasr, 2015), with various parasites being associated with different fish species. The prevalence of such infections is dependent on the nature of the ecosystems and fish susceptibility and result in considerable economic losses in the fisheries industry (Biu & Nkechi, 2013). Therefore fish parasitic diseases can be considered as one of the most detrimental factors to the success of the aquaculture industry (Paperna, 1996; Keremah & Inko-Tariah, 2013).

In Nigeria, studies revealed that freshwater fishes harbor ecto- and endo-parasites which affect fish health, growth and survival (Awharitoma & Okaka, 2004). Among the freshwater parasites, the economically important parasitic groups include the microparasites such as protozoans, the macroparasites comprising of the annelids and helminths such as trematodes (flukes), cestodes (tapeworms), nematodes (roundworms) and Acanthocephala (thorny headed worms) (Iyaji & Eyo, 2008; Ani *et al.*, 2017).

Community diversity and parasitic burden is known to be affected by the season, age, sex and environmental factors. Environmental factors such as pH, dissolved oxygen, extent of habitat and the proximity to a lake is known to influence parasite species richness in the host population (Karvonen *et al.*, 2003).

Therefore, this study sought to determine the prevalence of ecto- and endo-parasites in Apodu reservoir using the fish *Gnathonemus senegalensis* with the view of quantifying the helminthic burden and to evaluate the relationship between parasite burden and sex of fish and the water quality in the Apodu reservoir.

2. Material and Methods

2.1 Study Area

The Apodu reservoir (Figure 1) lies between the longitude 8°45'25.9"N, 8°45'27.7"N and latitude 4°27'41.4"E, 4°27'35.5"E. It was constructed in 1980 with re-impoundment of the dam being carried out in 2016 to ensure water availability to Malete and other villages around it (Oladipo *et al.*, 2018). The location of the reservoir falls within the Guinea savanna region of Nigeria which is characterized by two seasons – dry (November to March) and rainy (April to October) seasons. The reservoir is 560 m long and 400 m wide, has a depth of 8.2 m and the surface area of about 15 hectares (Oladipo *et al.*, 2018).

2.2 Sample Collection

A total 150 *Gnathonemus senegalensis* fish (Figure 2) were collected from Apodu reservoir, Malete, using gill nets and cast nets, set in the evening and harvested early morning, during November 2017 to April 2018. The fish were identified using the keys by Olaosebikan & Raji (1998) and Idodo-Umeh (2003). They were immediately transported in ice to the Parasitology laboratory, Kwara State

University Malete, for further examination.

2.3 Water Quality Analyses

Selected physicochemical parameters of the surface water were measured *in situ* using a Hanna portable combined waterproof tester model HI 98129. The measured parameters included electrical conductivity, temperature, pH and total dissolved solids. Transparency levels were also measured using the secchi disc with a calibrated rope attached while water velocity was measured using floatation method.

2.4 Sex Determination and Examination of fish parasites

The sex of the fish was determined by observing the genital pore and the presence or absence of testes or ovaries as apparent through examination under the microscope. The scales, fins, opercula, eyes and gills of freshly caught fish were examined for ecto-parasites with the aid of a hand lens and microscope. The ecto-parasites associated with fins were collected by severing the structures and placing them in a petri dish, and adding 0.9% of saline water, which was then viewed under a dissecting microscope.

Figure 1. Map of the study area

Figure 2. An adult *Gnathonemus senegalensis*

The parasites were picked and treated with 0.25 % aqueous formalin for 30 minutes and allowed to settle for 15 to 30 minutes. Using a dissecting microscope, the parasites were pipetted into alcohol-formalin-acetic acid (AFA) according to their taxonomic categories and fixed and preserved in 70 % alcohol (Upton, 2003). The gut was also examined for endoparasites, which were also fixed and preserved. The parasites were shaken in cold 4% formaldehyde until they died. They were then fixed in FAA (5% formal - 90% alcohol - 15% glacial acetic acid) for 2 hours prior to staining. The parasites were stained in aceto-carmin solution and mounted on permanent slides using Canada Balsam. Parasite identification was done by comparison of distinctive body shapes and the morphological features of the collected specimens and those described in literature and using the identification key modified from Frimeth (1994).

2.5 Data Analyses

The Incidence, and Intensity of parasitic infections, Density and Percentage of parasites and the Parasitic Index were calculated using the following equations (as used by Poulin & Rohde, 1997).

Incidence = (No. of parasites/ total host examined) X 100

Intensity = (No. of infected host/ No of parasites)

Density = (No. of parasite collected in a sample/ total host examined)

Index = (No. of parasites x No. of infected host/ total host examined)

Percentage = (No. of parasite/ No. affected) X 100

3. Results

Of the 150 fish of *Gnathonemus senegalensis* examined 63 samples were infested with parasites. Table 1 shows fish species examined in relation to sex, body weight and body length and the number infested; Male fish had a higher number of infections 24 (46.15%) in relation to number of fish examined while the female fish recorded 39 (39.80%). An infection rate of 52 % was observed in fish in the weight range of 31 – 40 g while the fish with the least number of infections was recorded in the range 51 – 60 g. Similarly, the highest number of infections (51) was observed in fish with the body lengths in the range of 15.6 – 21cm.

Table 2 shows monthly reports of fish samples examined including the percentages of the number infested, incidence and prevalence. The month of April had the highest prevalence and incidence with 62 fishes being infected giving the values of 98.41% and 41.33% for prevalence and incidence respectively. December had the lowest prevalence and incidence with 15 infected fishes (23.80% and 10%). The percentage incidence and prevalence of the parasites recorded during the study were 95.33 and 226.98 %, respectively.

The study revealed that a total of 10 species of parasites was recovered from the fish examined at the end of the sampling period (see Table 3). Seven species of parasites were recorded in the months of November and December 2017 with a total number of 19 and 13 individual parasites being recorded respectively in the two months. Five species were recovered in the months of January, February and March with a total of 16, 16 and 15 parasites respectively recorded in each of the months. The highest abundance of parasites – 62 individuals belonging to nine species, was recorded in April. The fishes were infested with the nematode

(*Capillaria* and *Camallanus*) in the intestine and trematodes (*Neascus* sp. and *Acanthocephalan* sp.) in the skin, intestine and gill, protozoans (*Tetrahymena* sp. and *Chilodonella* sp.) and monogeneans (*Dactylogyrus* sp. and *Gyrodactylus* sp.) in the skin and gills and the cestode (*Diphyllbothrium* sp.) found in the intestine.

The highest parasitic load was recorded in April 2018 [62 individuals, 98.41%] while both December 2017 and March 2018 recorded the lowest (15 individuals, 23.80%). *Capillaria* sp. has a high prevalence rate of 38[60.32%], followed by *Neascus* sp. with 19[30.16%] while the monogeneans (*Dactylogyrus* sp. and *Gyrodactylus* sp.) have the least prevalence of 6(9.52%).

Table 1: Occurrence of helminthic and protozoan parasites in relation to sex, body weight and body length of *Gnathonemus senegalensis*

Sex	No. of fish examined	No infected	Infection%
Male	52	24	46.15
Female	98	39	39.80
Total	150	63	42
Body weight in (g)	No. of fish examined	No infected	Infection%
20-30	17	6	35.29
31-40	75	39	52
41-50	28	9	32.14
51-60	24	7	29.17
61-70	6	2	33.33
Total	150	63	42
Fish length range (cm)	No. of fish examined	No infected	Infection%
10-15.5	29	12	41.38
15.6-21	121	51	42.15
Total	150	63	42

Table 2: Monthly variation in the prevalence and incidence of parasites in *Gnathonemus senegalensis*

Month	No. Of fish examined	No. infested	Total No. of parasite	% Incidence	% prevalence
November, 2017	20	7	19	12.66	30.16
December, 2017	20	5	15	10	23.80
January, 2018	30	14	16	10.67	25.40
February, 2018	30	16	16	10.67	25.40
March, 2018	30	12	15	10	23.80
April, 2018	20	9	62	41.33	98.41

Table 3: Monthly variations in the prevalence of helminthic and protozoan parasites in *Gnathonemus senegalensis*

Class	Site of infection	Months					
		Nov.	Dec.	Jan.	Feb.	Mar.	April
Nematode							
<i>Camallanus sp.</i>	GIT	-	1	-	3	2	1
	Gills	-	-	-	-	-	-
	Body surface	-	-	-	-	-	-
	Total	0	1	0	3	2	1
<i>Capillaria sp.</i>	GIT	1	-	3	6	-	28
	Gills	-	-	-	-	-	-
	Body surface	-	-	-	-	-	-
	Total	1	0	3	6	0	28
Cestode							
<i>Diphylllobothrium latum</i>	GIT	4	5	1	2	3	14
	Gills	-	-	-	-	-	-
	Body surface	-	-	-	-	-	-
	Total	4	5	1	2	3	14
Trematode							
<i>Neascus sp.</i>	GIT	-	-	-	-	-	-
	Gills	-	-	-	-	-	-
	Body surface	3	2	-	1	4	9
	Total	3	2	0	1	4	9
<i>Acanthocephalan sp.</i>	GIT	2	-	5	3	-	2
	Gills	-	-	-	-	-	-
	Body surface	-	-	-	1	-	-
	Total	2	0	5	4	0	2
Protozoan							
<i>Tetrahymena sp.</i>	GIT	-	-	-	-	-	-
	Gill	-	-	-	-	-	-
	Body surface	-	2	6	-	3	1
	Total	0	2	6	0	3	1
<i>Chilodonella sp.</i>	GIT	-	-	-	-	-	-
	Gill	-	-	-	-	-	-
	Body surface	6	2	-	-	-	5
	Total	6	2	0	0	0	5
Monogenea							
<i>Dactylogyrus sp.</i>	Gill	2	-	1	-	3	-
	Body surface	1	3	-	-	-	2

The analysis for the incidence, intensity, density and index of parasitic infestations were carried out and the results are presented in Table 4. *Capillaria sp.* had the highest incidence rate (25.33%) while both *Dactylogyrus sp.* and *Gyrodactylus sp.* had the lowest incidence rate of 4%.

The intensity rate for *Camallanus sp.* was recorded to be 8.57 % while the lowest intensity rate was recorded the highest density was in *Chilodonella sp.* (0.86%) while both *Dactylogyrus sp.* and *Gyrodactylus sp.* had the lowest density values (0.04%).

Table 4: Prevalence, incidence and intensity of infected *Gnathonemus senegalensis* in the Apodu reservoir

Parasites	No. of parasite	Percentage (Prevalence)	No. of fish examined	Incidence	No. of infected hostfish	Intensity	Density	Index
<i>Camallanus</i> sp.	7	11.1	150	4.67	6	0.857	0.046	0.28
<i>Capillaria</i> sp.	38	60.32	150	25.33	25	0.657	0.253	6.33
<i>Diphyllodotrium latum</i>	29	46.03	150	14.60	22	0.759	0.193	4.25
<i>Acanthocephalus</i> sp.	13	20.63	150	8.67	9	0.69	0.086	0.78
<i>Neascus</i> sp.	19	30.16	150	12.67	13	0.684	0.126	1.64
<i>Dactylogyrus</i> sp.	6	9.52	150	4	4	0.66	0.04	0.16
<i>Gyrodactylus</i> sp.	6	9.52	150	4	5	0.83	0.04	0.20
<i>Tetrahymena</i> sp.	12	19.05	150	8	7	0.583	0.84	0.56
<i>Chilodonella</i> sp.	13	20.63	150	8.67	10	0.769	0.86	0.86

Table 5: Mean physicochemical parameters of the Apodu reservoir during the sampling periods

Month	Temp (°C)	TDS (ppm)	Water current(m/s)	Conductivity (μ^2/cm)	pH	Transparency(m)
November	26.8±0.21	36±0.75	0.045±1.02	71±0.41	7.70±0.25	116±0.42
December	26.4±0.24	34±0.55	0.075±0.27	66±0.75	7.98±0.36	220±0.31
January	26.5±0.37	44±0.13	0.04±0.31	83±0.45	7.62±0.31	328±0.75
February	26.5±0.26	36±0.20	0.42±0.24	76±0.51	7.61±0.13	402±0.45
March	26.9±0.21	38±0.22	0.061±0.13	74±0.55	7.54±0.22	310±0.56
April	26.5±0.14	36±0.16	0.077±0.11	72±0.37	7.68±0.14	110±0.37

Table 6: Correlation between physicochemical parameters, number of fish infested and the number of parasite

Variables	Temp (°C)	TDS (ppm)	Water current (m/s)	Conductivity (μ^2/cm)	pH	Transparency(m)	No. of fish infested	Total No. of parasite
Temp (°C)	0	0.25	0.58	0.73	0.28	1	0.73	0.9
TDS (ppm)	0.55	0	0.28	0.07	0.15	0.47	0.18	1
Water current(m/s)	-0.33	-0.58	0	0.71	0.80	1	0.71	0.89
Conductivity(μ^2/cm)	0.21	0.82	-0.14	0	0.10	0.14	0.01	0.98
pH	-0.58	-0.70	-0.09	-0.77	0	0.18	0.03	0.67
Transparency(m)	-0.03	0.39	0.03	0.71	-0.6	0	0.10	0.33
No. of fish infested	0.21	0.64	0.15	0.94	-0.83	0.77	0	0.98
Total No. of parasite	0.06	0	0.09	0.03	0.21	-0.50	0.03	0

The physicochemical factors of water that were recorded during the study period are shown in Table 5. The temperature of the reservoir during the period ranged between 26.4 and 26.9 °C with the highest value of 26.9°C recorded in March and the lowest 26.4°C in December. The conductivity ranged between 66 and 83 $\mu\text{s}/\text{cm}$ while TDS was between 34 - 44 ppm. The water current varied throughout the period. The highest and lowest water currents observed was 0.42 and 0.04 m/s, respectively. The transparency of the reservoir ranged between 110 and 402 cm with the highest being 402 cm recorded in March. The pH values recorded during the study ranged from 7.54 - 7.98.

4. Discussion

The present study shows a low-average infection rate of the sampled fishes from the Apodu reservoir, Maleté, with all parasites recovered being endo-and ectoparasites representing nematodes, cestodes, trematodes, monogeneans and protozoans. In the study, the results obtained from the examination of the occurrence of helminthes and protozoan parasites in relation to the sex of the host showed that more males were infected with helminthes parasites. This infestation may be due to differential feeding habits and as a result of different degrees of resistance to parasitic infections (Ayanda, 2009). This findings show that, the higher infection in smaller fishes increases the activities of the intestinal parasites that contributes to a decrease in body weight which is consistent with the findings of Oniye *et al.* (2004).

The number of nematodes isolated was higher than that of cestodes, trematodes, protozoans and monogeneans. This agrees with the findings of Akinsanya *et al.* (2007) describing nematodes to be a body cavity parasite known also to penetrate subcutaneous tissues. *Capillaria* sp. in this study had the highest prevalence in *Gnathonemus senegalensis* which may be as a result of its feeding

habit in that digestive activities take place in the intestine leading to the release of parasites in food particles (Jenyo, 2011; Ekanem *et al.*, 2011). Acanthocephalans were found in the intestine of the examined fish which agrees with the findings of Olurin & Somorin (2006) reported for fishes from the Owa stream. A low rate of *Dactylogyrus* sp. and *Gyrodactylus* sp. found on the gills and body surface, respectively, could be attributed to the continuous movement of water currents over the gills, skin and fins.

Occurrence of parasites varies across months which could be due to changes in host - parasite relationships and abiotic factors such as transparency, temperature, water current and pH, which would in turn be due to changes in the host's feeding habitats in relation to physical factors of the water body. Such changes will then contribute to temporal variations in the prevalence and intensity of parasites. The prevalence of gastrointestinal helminthes and protozoans in *Gnathonemus senegalensis* is high and may bring about a reduction in the economic value and productivity of these fish in Apodu reservoir. Hence, it is important to know how such parasitic infestations could affect fish productivity, their market value and palatability.

References

- Adebisi, A.A. (1978) Analysis of stomach contents of Piscivorous fishes of upper Ogun River in Nigeria. *Hydrobiologia* **79**: 167-177.
- Akinsanya, B., Otubanjo. O.A., Hassan A.A. (2007) Helminth parasites of *Malapteruruselectricus* Malapteruridae from Lekki Lagoon, Lagos, Nigeria. *Journal of American Science* **3** (3): 1-5.
- Ani, O.C., Nnamonu, E.I., Ejiogu C. (2017) Prevalence of Intestinal Parasites of Fish Farmed and Harvested in Abakiliki,

Nigeria: A Pointer to the Level of their Vulnerability. *International Journal of Research in Pharmacy and Biosciences* **4** (9): 7-10

Awharitoma, A.O., Okaka, C.E. (2004) Parasites of fishes from Ikboba River and Ogba River Fish farm. *Nigeria Journal of Applied Science* **22**: 355-0-362.

Ayanda, O.I. (2009) Comparison of Parasitic Helminthes Infection between the Sexes of *Clarias gariepinus* from Asa Dam Ilorin, North-Central Nigeria. *Scientific Research and Essay* **4**: 357-360

Bamidele, A. (2015) A two fish species study of the parasitic helminth fauna of *Synodontis filamentosus* (BOULENGER, 1901) and *Calamoichthys calabaricus* (SMITH, 1865) From Lekki Lagoon, Lagos, Nigeria. *Ife Journal of Science* **17** (1): 97-108.

Biu, A.A., Nkechi, O.P. (2013) Prevalence of gastrointestinal helminths of *Tilapia zilli* (Gervais 1848) in Maiduguri, Nigeria. *Nigerian Journal of Fisheries and Aquaculture* **1** (1): 20-24.

Biu, A.A., Diyaware, M.Y., Yakaka, W., Rita, D.J. (2014) Incidence of Parasites of *Clarias gariepinus* (Burchell, 1822) Caught from Lake Alau, Maiduguri, Borno State, Nigeria. *Nigerian Journal of Fisheries and Aquaculture* **2** (1): 74-80.

Ekanem, A.P., Eyo, V.O., Sampson, A.F. (2011) Parasites of landed fish from Great Kwa River, Calabar, Cross River State, Nigeria. *International Journal of Fisheries and Aquaculture* **3** (12): 225-230.

Frimeth, J. (1994) General Procedures for Parasitology. In: Suggested procedures for the detection and identification of certain finfish and shellfish pathogens, (Thoesen J, editor). Fourth edition, Fish Health Section, Bethesda, MD: *American Fisheries Society* 5-6.

Holden, M., Reed, W. (1972) *West African freshwater fish*. Longman Group Ltd. London, 68 p.

Idodo-Umeh, G. (2003) *Freshwater fishes of Nigeria (taxonomy, ecological notes, diet and utilization)*. First Edition, Idodo-Umeh Publishers Ltd, Benin City. Nigeria, 238 p.

Iyaji, F. O., Eyo, J.E. (2008) Parasites and their Freshwater Fish Host. *Bio-Research* **6** (1): 328 – 338

Jenyo-Oni, A., Obe, B.W. (2011) Assessment of Fish Biodiversity in Oni River, Ogun State, Nigeria. *International Journal of Agricultural Management & Development* **1** (3): 107-113

Karvonen A., Paukku S., Valtonen E. Karvonen A., Paukku S., Valtonen E.T., and Hudson PJ (2003) Transmission, infectivity and survival of *Diplostomum spathaceum cercariae*. *Parasitology* **127** (3): 217-24.

Keremah, R.I., Inko-Tariah, M.B. (2013) Comparative study of ectoparasites on Nile tilapia (*Oreochromis niloticus*) cultured under integrated and unintegrated pond systems. *African Journal of Biotechnology* **12** (19): 2711.

Oladipo, S.O., Mustapha M.K., Suleiman L.K., Anifowoshe A.T. (2018) Fish composition and diversity assessment of Apodu reservoir, Malet, Nigeria. *International Journal of Fisheries and Aquatic Studies* **6** (2): 89-93

Olaosebikan, B.A., Raji, A. (1998) *Field Guide to Nigerian Freshwater Fish*. Federal College of Freshwater Fisheries Technology, New Bussa, 106 p.

Oluorin, K. B., Somorin, C. A. (2006) Intestinal helminths of fish of Owa stream South-West Nigeria. *Research Journal of Fisheries and Hydrobiology* **1** (1): 6-9.

Oniye, S. J., Adebote, D. A., Ayanda, O. I. (2004) Helminth Parasite of *Clarias*

gariepinus in Zaria, Nigeria. *African Journal of Aquatic Science* **19**: 71-76.

Paperna, I. (1996) Parasite, Infections and Disease of Fishes in Africa—An Update. *CIFA Technical Paper*, **31**, 1-220.

Poulin, R., Rohde, K. (1997) Comparing the richness of metazoan ectoparasite communities of marine fishes: Controlling for host phylogeny. *Oecologia* **110**: 278-283.

Ravichandran, S., Balasubramanin, T., Kannupandi, T. (2007) Incidence of parasitic isopods on the fish *Sphyræna obtusata*. *Research Journal Parasitology* **2 (1)**: 45-50.

Roberts, L.S., Janovy, J. (Jr.) (2009) *Foundations of Parasitology*, Eighth Edition, McGraw-Hill International, Boston, 502p.

Soliman, N.F., Nasr, S.M. (2015) Metal contents in common edible fish species and evaluation of potential health risks to consumers. *Journal of Coastal Life Medicine* **3 (12)**: 956-961.

Upton, S.J. (2003). *Animal Parasitology*, Biology 625: Laboratory manual. 31 p.