Gastrointestinal helminth parasites of *Malapterurus electricus* from Anambra River, Nigeria.

Abstract

Aim: One of the constraints of fish in the wild for sustainable productivity is parasitic infections. The study was carried out to determine the gastrointestinal helminth parasites associated with *Malapterurus electricus* and their prevalence in relation to sex and size.
Study Design: The study was a survey done to establish the type of gastrointestinal helminth parasites found in *M. electricus*.
Place and Duration of Study: The specimens were collected from Anambra River between August and December 2018.
Methodology: A total of thirty-two (32) fishes were examined through dissection and observation of the alimentary canal under the objective lens of the microscope. The chi-square test was employed to determine the possible association between parasite prevalence, the sexes, and size. **Results:** The overall prevalence of parasites was 56.25%. The parasites recovered were, *Malapterurus electricus* (50.00%) and *Tenuisentis niloticus* (6.25%). The male specimens (18) recorded a prevalence of 66.67% while the female (14) recorded a prevalence of 42.86%. There was no significant difference in the prevalence of gastrointestinal helminths among gender (P=0.178, P>0.05). The length group, 30 – 39cm had a 100% prevalence. Thus, a significant difference between the fish size and parasite prevalence was observed. The weight groups, 100 - 199g, and 400 - 499g also had a 100% prevalence. However, no significant relationship was observed between fish weight and parasite prevalence. The study showed the intestine as the most preferred microhabitat.
Conclusion: This study showed that there is high prevalence of gastrointestinal helminth parasites in *M. electricus.* It is therefore expedient to cook fish properly to avoid the ingestion of parasites by consumers which may pose a health risk to humans.

Keywords: *Malapterurus electricus*, Anambra River, Helminth parasites, *Tenuisentis niloticus.*

1.0 INTRODUCTION

The increased necessity to raise fish for human consumption as a source of nutrition for the thronging, quickly expanding populations in developing countries has necessitated a stepped-up investigation of the parasite fauna of African freshwater fish. However, one of the challenges confronting aquaculture is parasite [1]. Parasites represent an important source of economic losses for aquaculture in terms of reduced fish growth and increased mortality, and also in terms of investments in the farming practices and chemicals necessary for their prevention [1].

One of the major fishes in aquaculture is *Malapterurus electricus* (Forskali, 1775). *Malapterurus electricus* can be found in Western and Central tropical Africa and along the Nile River. *Malapterurus electricus* comprising three species may also be found in all of Africa's major freshwater systems [1]. The body form of *M. electricus* has been compared to that of a swollen sausage. Their soft, puffy bodies give them the appearance of a hard sausage driven by ostraciform movements while they swim [2]. *M. electricus* most noticeable feature is its great electrogenic capacity. Its pectoral muscle gave rise to the electric organ. This organ likewise surrounds the fish's body for the majority of its length and may discharge up to 350 volts (in a 500mm fish) [1]. The electric organs of *M. electricus* have been used in studies of neuronal metabolism, axonal transport, and transmitter release (Volknandt and Zimmermann, 1986), yet information on the parasite fauna of *M. electricus* seems to be scarce when compared to other fish species.

In some parts of Nigeria, parasite documentation on *M. electricus* includes *Electrotaenia malapteruri*, *Tenuisentis niloticus*, and *Nilonema* species [3] in Lagos; *Procamallanus* species (Edema *et al*., 2008) in Benin City; *Procamallanus laeviconchus* [4]; *Henneguya* species (Protozoa), *Clinostomum* species (Trematoda), *Diphyllobothrium latum* (cestode) and *Capillaria* species, *Contracaecum* species, *Eustrongylides* species (Nematoda) [1] in River Benue. [5] at Rivers Niger-Benue Confluence also recovered protozoan ciliate (*Trichodinids*), cestodes (*Monobothrioides woodlandi, E. malapterurid,* and *Proteocephalus largoploglotis*) and nematodes (*P. laeviconchus*, *Rhabdochona congolensis,* and *Camallanus* species). However, there is a paucity of information on the parasites of *M. electricus* from Rivers in Anambra State. Therefore, this study aims at providing information on the gastrointestinal helminth parasites of *M. electricus* from the Anambra River, Nigeria because of their importance in the artisanal fisheries of the basin.

2.0 MATERIALS AND METHODS

2.1 Study Area

The study was conducted in the Anambra River, Southeastern, Nigeria. It is a major tributary of the River Niger. The water emerges from a somewhat inaccessible point near Ankpa in the Kogi State of Nigeria, crosses the Kogi/Anambra State boundary a bit north of Ogurugu, and then meanders through the Ogurugu station to Otuocha, then flows down to its confluence with the Niger at Onitsha [6]. Anambra River Basin lies between latitudes $6^{0}10^{1}$ and $7^{0}8^{1}$ N and longitudes $6^{0}30^{1}$ and $7^{0}15$E (mapcarta.com). The basin has an annual rainfall between 150cm-200cm. The area has a low altitude of under 1000 above sea level. Temperatures are uniformly high with a small annual range of 5-10^{o}C. The study area is one of the richest areas for agricultural and fishery production in Nigeria [7], thus agriculture and fishing form the dominant occupations of the local people. These two major economic activities are closely geared to the two seasons of the year (wet and dry seasons).

2.2 Collection of Fishes

Thirty-two (32) *M. electricus* (18 males and 14 females) were purchased from local fishermen at Otuocha market, Anambra State. The fishes were transported to the Parasitology Laboratory of the Department of Zoology, Nnamdi Azikiwe University. The weights, standard lengths, and total lengths of the fish were recorded. The weights were recorded to the nearest gram using Adams electronic weighing balance; model AQP 1600 while the lengths of the fishes were determined using a measuring board calibrated in centimeters. The sexes of the fish were determined by examination of their papillae and were immediately subjected to parasitological examinations.

2.3 Examination of Gastrointestinal Tract for Helminths

The fishes were dissected and the alimentary canals were removed and cut into parts in different Petri dishes containing physiological saline for parasite recovery. The intestines were further carefully slit open to aid the emergence of parasites starting from the cloacal end to reduce the chances of cutting long helminths such as cestodes that may extend from one section into another [8]. The recognition of the worms was enhanced by the wriggling movements on emergence.

2.4 Identification of Parasites

Parasites seen were picked up with a small paintbrush. Cestode parasites were relaxed in the water and preserved in 70% alcohol. Acanthocephalans were shaken vigorously in cold 4% formaldehyde until they died. They were also preserved in cold 4% formaldehyde. The number of parasites per fish was recorded along with the site/location from which each parasite was collected. The parasites were identified using keys developed by [9], [10], [11], [12], [13], and [14].

2.5 Statistical Analysis

Infection statistics of [15] were used for the determination of prevalence, mean intensity, and mean abundance. Chi-Square was done to determine the relationship between fish sex, length, weight, and helminth infection at a 95% significant level ($P<0.05$).

3.0 RESULTS

Out of the 32 *M. electricus* examined, 18 (56.25%) were infected while 14 (43.75 %) were uninfected. A total of 112 parasites belonging to one species of cestode (*Electrotaenia malapteruri*) and one species of acanthocephalan (*Tenuisentis niloticus*) were recovered from the fishes. Among the two parasites, *M. electricus* recorded a prevalence of 50.00% while *T. niloticus* recorded a prevalence of 6.30%. Both parasites were recovered from the intestine (Table 1).

The prevalence of gastrointestinal helminths was higher in males 12(66.67%) than in females 6(42.86%). However, there was no significant difference in the prevalence among gender (P = .178, P>0.05) [Table 2].

The length groups 10 - 19cm had a prevalence of 50.0%, and 20 - 29cm (54.0%), while the highest length groups 30 - 39cm had a 100% prevalence. A significant difference between size and parasite prevalence was observed (0.866; P<0.05) [Table 3].

The weight groups 0 – 99g had a prevalence of 66.67%, 100 – 199g (100%), 200 – 299g (16.67%), and 300 – 399g (75%) while the highest weight groups 400 – 499g recorded 100% prevalence of infection. However, no significant relationship between weight and parasite prevalence was recorded (13.714; P> – 0.008) [Table 4].

Table 1= Parasite species spectrum in *M. electricus* from Anambra River.

Parasite species	**Number examined**	**Number infected**	**Prevalence (%)**	**N. P. R**	**M.I.I**	**M.A**
Electrotaenia malapteruri	32	16	50.00	110	6.87	3.43
Tenuisentis niloticus	32	2	6.30	2	1.00	0.10

*N.P.R = number of parasites recovered; *M.I.I = mean intensity of infection; *M.A = mean abundance

Table 2 = Relationship between sex and prevalence of gastrointestinal helminth infection

	Male	**Female**	**Combined sex**
Number examined	18	14	32
Number infected	12	6	18
Prevalence (%)	66.67	42.86	56.25

□^{2}= 1.814, df = 1, *P*-value = .178

Table 3 = Relationship between size distribution and gastrointestinal helminth infection.

Body size (cm)	**10 – 19**	**20 – 29**	**30 -39**
Number examined	6	24	2
Number infected	3	13	2
Prevalence	50.00	54.00	100.00
N.P.R	24	51	37
M.I.I	8.00	3.92	18.50
M. A	4.00	2.13	18.50

□^{2} = 0.866; *P*<0.05

Table 4 = Relationship between fish weight and gastrointestinal helminth infection.

Body weight (g)	**0 - 99**	**100 - 199**	**200 - 299**	**300 - 399**	**400 - 499**
Number examined	6	4	12	8	2
Number infected	4	4	2	6	2
Prevalence (%)	66.67	100. 00	16.67	75.00	100.00
Mean intensity	6.00	2.00	1.33	4.50	18.50

χ^2 = 13.714, df – 4, *P*-value – 0.008

DISCUSSION

The recovery of *E. malapteruri* and *T. niloticus* in this study is not surprising as they have been recorded previously from the fish species by Iyaji and Eyo (2014) in Rivers Niger – Benue Confluence, [3] in Lekki Lagoon, and [6] in Anambra River. Surprisingly, [1] in their study of Ecto and intestinal parasites of *M. electricus* from upper river Benue did not recover any of these parasites. The reason may be attributed to the location and sampling.

Of the two parasite species recorded, *E. malapteruri* had the highest prevalence of 50.00%. Numerous fish species have been known to be infected by cestode (tapeworm) parasites, which are widely distributed in all major freshwater systems of Africa and demonstrate a high degree of host specificity [5]. According to [16], proteocephalid cestode infection of fish hosts involves a complex life cycle of intermediate and definitive hosts. This complex life cycle may be the reason *E. malapteruri* has been characterized as being host-specific. [17] and [18] also affirmed the host specificity of *E. malapteruri.*

The recovery of *T. niloticus* agrees with [3] who made the first scientific report on *T. niloticus* in *M. electricus.* This may be due to the omnivorous feeding habits of *M. electricus.* It is also of interest to note that the host specificity of acanthocephalans is variable [3] as they tend to develop via one or more intermediate hosts that fish can serve as.

The relationship between host sex and helminth infection showed that males had a higher prevalence than females although infections were not significant. Similar observations have been made in other studies [19]; [20]; [21]; [22]; [1]. The reason for the difference in the incidence of infection could be due to differential feeding either by quantity or quality of food eaten. It may also be a result of different degrees of resistance and infection [1]. Thus, the infection could be by chance.

The significant relationship recorded between size (length) and helminth infection was also reported by [5], and [3]. The increase in parasitism with size may be because older fishes have a longer time to pick up parasites than younger ones since they supposedly feed more [5]. This may also be attributed to the fact that older fishes engage in more activity requiring a high rate of metabolism and so feed more. Although there was a significant difference between size (length) and helminth infection, infections were not significant with the weight of *M. electricus*. However, the heavier fishes had the highest mean intensity of 18.50. This could be attributed to the random selection of the fish.

CONCLUSION

The finding from the present study showed that there was a high prevalence of helminth parasites in *M. electricus*. The total number of parasites recovered was also high. Humans who eat undercooked parasites infected fishes are at risk of the infection. Further studies are still required to establish factors responsible for the abundance of parasites in fish of the Anambra River particularly *M. electricus.*

ETHICAL APPROVAL

This study followed guidelines for the care and use of experimental animals established by the Animal Care and Use Committee of Nnamdi Azikiwe University, Awka, Nigeria, for the control and supervision of experiments on animal (RE: NAU/AREC/2023/00025)

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