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Endoparasitic fauna and Condition factor of two fish species from Lower River Benue, Nigeria

[1]OMEJI, S., [2]GARBA, A.A., [3]AGBO, J.O.

[1,3]Department of Fisheries and Aquaculture, University of Agriculture, P.M.B. 2373, Makurdi, Benue State, Nigeria
[2]Department of Fisheries and Aquaculture, Faculty of Agriculture, Bayero University, Kano, Nigeria

Abstract: **Endoparasitic fauna and Condition factor of *Synodontis euptera* and *Auchenoglanis occidentalis* from Lower River Benue, Nigeria was determined. Out of the 90 samples of *S. euptera,* used for the study, 24 smples were infested with 61 parasites; while stomach accounted for 27 parasites belonging to one species of nemtoda (40. 74% *Eustrongylydes sp.*,Plate 1) and cesdtoda (48.15% *Diphilobothrium latum*, Plate 2), intestine had 34 parasites belonging to two species of nematoda (26.47% *Eustrongylydes sp*, 14.71% *Cocullanus sp.*, Plate 3) and one species of cesdtoda (67.65% *Diphilobothrium latum*). Of the 90 samples of *A. occidentalis,* 19 smples were infested with 57 parasites; while stomach accounted for 28 parasites belonging to one species of nemtoda (46.43% *Eustrongylydes sp*) and cesdtoda (53.57% *Diphilobothrium latum*), intestine recorded 19 parasites belonging to one species of nematoda (31.58% *Eustrongylydes sp*) and cesdtoda (68.42% *Diphilobothrium latum*).Parasitic prevalence of 26.67% and 21.11% were recorded for *S. euptera* and *A. occidentalis,* respectively. Variation in percentage helminth parasites existed among the length groups of *S. euptera* being most prevalent (50.82%) in length group 30.1-40.00cm but lowest (4.92%) in length group 0-20.0cm. Also, variation in percentage helminth parasites existed among the length groups of *A. occidentalis* being most prevalent (61.70%) in length group 31.2-46.70cm but lowest (10.64%) in length group 15.60-31.20cm. The highest K of infected male (0.91-+0.29) and female (1.21+_0.00) of *S. euptera* were recorded in the month of October while the lowest (0.75±0.08) and (0.72±0.00) were recorded in the month of September. Highest K (1.58=+0.32) and (1.51 +-0.29) for uninfected male and female were recorded in the month of July. In addition highest K of infected male (1.3+-0.03) and female (1.43+-0.02) for *A. occidentalis* were recorded in the month of October 2017, while the lowest (0.97+-0.01 and 0.94+-0.02) where recorded in the month of September, 2017. Whereas highest k (1.78+0.35 and 1.73+-0.32) of male and female *A.occidentalis* was recorded in the month of July, 2017 while the lowest (1.10+-0.06 and 1.07+-0.15) were recorded in the month of September, 2017. Female *S. euptera* had higher percentage parasite infestation (55.74%) from 62.55% infected fish samples than the male (44.26%) parasites from 37.5% infested fish. Also, female *A. occidentalis* had higher parasite infestation (65.45%) from 63.16% infected fish than the male with 34.55% parasite infestation from 36.84% infected fish.**

Keywords: **Endoparasitic fauna, Condition factor, *Synodontis euptera, Auchenoglanis, Occidentalis, Lower River Benue, Nigeria.***

1. INTRODUCTION

Parasites are a major concern to freshwater and marine fish all over the world, and of particular importance in the tropics (Iyaji and Eyo, 2008; Bichi and Dawaki, 2010; Ekanem *et al.*, 2011). They constitute a major limiting factor to the growth of farmed fish in Nigeria (Bichi and Yelwa, 2010). The effects of parasites on fish are numerous, some of which include nutrient devaluation (Hassan *et al*., 2010); alteration of biology and behaviour (Lafferty, 2008); lowering of immune capability, induction of blindness (Echi *et al*., 2009 a, b); morbidity, mortality, growth and fecundity reduction (Nmor *et al*., 2004) and mechanical injuries depending on the parasite species and load (Echi *et al*., 2009 a, b).

One of the scientific significance of identifying a fish properly is to tell to some reliable extent the health condition of the fish, and certain parasitic infestations/infections of the fish. The well-being of fish and their population in general can be determined by analyses of condition factor (Schmitt and Dethloff 2000).

The composition of the parasite fauna is a product of interactions of biotic and abiotic factors of the environment. For parasites to maintain their populations, all parasites need is to eventually reproduce and infect new hosts. Therefore, one factor that may be contributing to the lower rate of infection of parasites in the exposed water body could be a lower density of host populations. Host density is especially critical since the free-living transmission stage of some parasites is relatively short-lived (Mackenzie *et al*., 1995).

All fish species are vulnerable to various parasitic infections depending on the species and the type of stream inhabited (Edema, 2008). There are times when changes in the environment (natural or anthropogenic) can change the state of balance of the parasite between host and nature, thus resulting in disease. These changes can be environmental such as temperature, climate, or anthropogenic such as pollution and urbanization (Lafferty and Kuris 1999). When the dynamic equilibrium between host and parasite is lost, some changes can occur within the host. These changes can cause mechanical damage (fusion of gill lamellae, tissue replacement), physiological damage (cell proliferation, immunomodulation, altered growth, detrimental behavioral responses,) and/or reproductive damage (Buchman and Lindstrøm 2002, Knudsen *et al*. 2009, Al-Jahdali and Hassanine 2010).

2. MATERIALS AND METHODS

Sample Collection, Identification, Lengths Measurement and Sex Determination:

180 randomly selected live fishes comprising of 90 samples each of *Synodontis euptera* and *Auchenoglanis occidentalis* of different sizes were bought from Wadata market. Twenty samples each from the sampling site were collected monthly for a period of four months and transported to the Fisheries Laboratory, University of Agriculture, Makurdi in plastic jars. Fishes were identified to species level (Olaosebikan and Raji, 2004). The total and standard lengths of each fish were measured in centimetres (cm) using a meter rule while the weight of each of the fish was taken in grams (g) using an electronic weighing balance. The sex of fish was ascertained by both morphological examination and observation of the presence of testis and ovary using dissecting microscope upon dissection of the fish to expose the gonads (Ayanda, 2009).

Processing of Parasites Recovered:

The cavity of each fish was cut opened ventrally with a pair of scissors and the internal organs removed for examination. The stomach and intestine of each of the fish were dissected and the alimentary canals were removed and cut into parts in physiological saline (0.9ml) for parasite recovery. Thereafter, they were further carefully split open longitudinally to aid the emergence of the parasites. Contents of the stomachs and intestines were further washed into the Petri-dish containing the saline solution and one to two drops of the preparation were placed on slide covered with slips and observed at × 100 magnifications under phase contrast microscope. The recovered parasites were sorted out into groups and identified using taxonomic guides by Paperna (1996), counted and recorded.

Condition Factor of the Fish Species:

The condition factor also known as the Ponderal index or the Fulton Coefficient of condition was computed using the formula described by Le Cren, (1951) as thus;

$$K = \frac{100W}{L^b}$$

Where

b =Value obtained from the growth exponent in the length W=Total weight of fish (g) L= Standard length (cm) K= Condition factor

Data Analysis:

Analysis of parasitic infestation for finding the prevalence and intensity were carried out using the equations by Poulin and Rohde (1997):

$$\text{Prevalence (\%)} = \frac{\text{Numberoffish infected}}{\text{numberoffish examined}} \times 100$$

$$\text{Mean Intensity} = \frac{\text{Total Number of Parasites}}{\text{Number of fish infested}}$$

The relationships between factors such as host sex, weight, total length, locality, and parasitic infection were obtained from pooled data using analysis of variance (ANOVA). All statistical analysis was done using SPSS version 17.0.

3. RESULTS

Results of the Prevalence of intestinal helminth parasite in *Synodontis euptera* and *A. occidentalis* from Lower River Benue are presented in Table 1. Of the 90 samples of *S. euptera*, 24 smples were infested with 61 parasites; while stomach accounted for 27 parasites belonging to one species of nemtoda (40. 74% *Eustrongylydes sp.*,Plate 1) and cesdtoda (48.15% *Diphilobothrium latum*, Plate 2), intestine had 34 parasites belonging to two species of nematoda (26.47% *Eustrongylydes sp*, 14.71% *Cocullanus sp.*, Plate 3) and one species of cesdtoda (67.65% *Diphilobothrium latum*).

Of the 90 samples of *Auchenoglanis occidentalis*, 19 smples were infested with 57 parasites; while stomach accounted for 28 parasites belonging to one species of nemtoda (46.43% *Eustrongylydes sp*) and cesdtoda (53.57% *Diphilobothrium latum*), intestine recorded 19 parasites belonging to one species of nematoda (31.58% *Eustrongylydes sp*) and cesdtoda (68.42% *Diphilobothrium latum*).

Parasitic prevalence of 26.67% and 21.11% were recorded for *S. euptera* and *A. occidentalis*, respectively.

Plate 1: *Estrongylides sp*

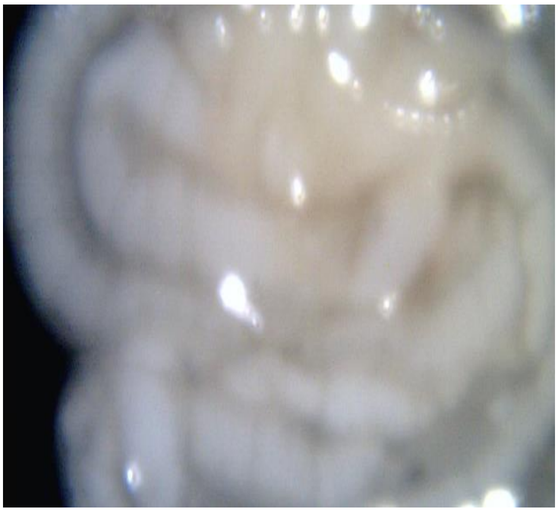

Plate 2: *Diphilobothrium latum*

Plate 3: *Coculanus sp*

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Table 1: Prevalence of intestinal helminth parasite in *S. euptera* and *A. occidentalis* from Lower River Benue

		S. euptera				*A. occidentalis*			
				% parasites infestation				% parasites infestation	
Parasites	Taxonomic group	% of fish infested	Prevalence of infested fish	Stomach	Intestine	% of fish infested	Prevalence of infested fish	Stomach	Intestine
E. Sp	Nematoda	37.50	10.00	40.74	26.47	42.11	8.89	46.43	31.58
D. latum	Cestoda	45.83	12.22	48.15	67.65	57.89	12.22	53.57	68.42
Cocullanus sp	Nematoda	16.67	4.44	0.00	14.71	0.00	0.00	0.00	0.00
TOTAL		**100.00**	**26.67**	**100.00**	**100.00**	**100.00**	**21.11**	**28 (100.00)**	**100.00**

Table 2 shows the results of pattern of intestinal helminth parasites in *S. eupterus* and *A. occidentalis* in relation to total length (cm) from Lower River Benue. Variation in percentage helminth parasites existed among the length groups of S. euptera being most prevalent (50.82%) in length group 30.1-40.00cm but lowest (4.92%) in length group 0-20.0cm. Also, Variation in percentage helminth parasites existed among the length groups of *A. occidentalis* being most prevalent (61.70%) in length group 31.2-46.70cm but lowest (10.64%) in length group 15.60-31.20cm. Highest and lowest prevalence (60.00% and 20.63%) were recorded for length groups 40.1-50.00 and 30.1-40.00 cm, respectively. Highest mean intensity (3.00) was recorded for length groups of 0.20 and 40.1-50cm, respectively but generally mean intensity of 2.54 was recorded for *S. euptera*

Also a variation in percentage intestinal helminth parasite existed among the length groups of *A. occidentalis* being more prevalent (61.70%) in length groups 31.2-46.70cm but lowest (10.64%) in length groups 15.6-31.20cm. No parasite was found in length group 0-15.5cm.

Highest and lowest prevalence (38.40%) and (4.76%) were recorded for length groups 31.2-40.7 and 0-15.5cm, respectively. Mean intensity was highest (2.90) in length group 31.2-46.70cm but lowest (1.67) in length from 15.6-31.2cm. Generally 2.47 mean intensity was recorded for *A. occidentalis* during the study period

Table 2: Pattern of intestinal helminth parasite in *S. euptera* and *A. occidentalis* in relation to total length (cm) from Lower River Benue

Fish species	Length (Cm)	% of fish examined	% fish infested	% of recovered parasites	Prevalence	Intensity
S. euptera	0-20	2.22	4.17	4.92	50.00	3.00
	20.1-30	22.22	29.17	29.51	35.00	2.57
	30.1-40	70.00	54.17	50.82	20.63	2.38
	40.1-50	5.56	12.50	14.75	60	3.00
	TOTAL	**100.00**	**100.00**	**100.00**	**26.67**	**2.54**
A. occidentalis	**Length (Cm)**	**% of fish examined**	**% fish infested**	**% of recovered parasites**	**Prevalence**	**Intensity**
	0-15.5	23.33	5.263	0.00	4.76	0.00
	15.6-31.2	20.00	15.79	10.64	16.67	1.67
	31.2-46.7	28.89	52.63	61.70	38.46	2.90
	46.8-62.3	27.78	26.32	27.66	20.00	2.60
	TOTAL	**100.00**	**100.00**	**100.00**	**21.11**	**2.47**

Results of the pattern of intestinal helminth parasites in relation to weight of the fish samples are presented in Table 3.

Highest and lowest percentage parasites (47.54%) and (11.48%) for *S. euptera* were recorded from 41.67% and 20.83% infested fish samples in the length of 200.1-300g and 101.1-200g, respectively. Highest and lowest prevalence of infested

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fish (85.71%) and 20.00%) were recorded for length groups of 400.1-500g and 300.1-400g, respectively. In addition highest and lowest percentage parasite infestation (40.00% and 7.27%) for *A. occidentalis* were recorded for 36.84% and 5.26% infested fish samples in the weight groups of 101.1-200g and 0-100g, respectively.

Highest and lowest prevalence of infested fish (40.00% and 3.45%) were recorded for weight groups of 300.1-40g and 0-100g, respectively.

Table 3: Pattern of intestinal helminth parasite in *S. euptera* and *A. occidentalis* in relation to weight (g) from Lower River Benue

	S. euptera				*A. occidentalis*			
Weight range (g)	% fish examined	% of fish infested	% parasite recovered	Prevalence of infested fish	% fish examined	% of fish infested	% parasite recovered	Prevalence of infested fish
0-100	17.78	0.00	0.00	0.00	32.22	5.26	7.27	3.45
101.1-200	26.67	20.83	11.48	20.83	25.56	36.84	40.00	30.43
200.1-300	31.11	41.67	47.54	35.71	23.33	26.32	23.64	23.81
300.1-400	16.67	12.50	24.59	20.00	11.11	21.05	18.18	40.00
400.1-500	7.78	25.00	16.39	85.71	7.78	10.53	10.91	28.57
Total	**100.00**	**100.00**	**100.00**	**26.67**	**100.00**	**100.00**	**100.00**	**21.11**

Table 4 shows the monthly mean condition factor (K) of infected and uninfected male and female *S. euptera* and *A. occidentalis* from lower river benue.

The highest k of infected male (0.91-+0.29) and female (1.21+_0.00) of S. euptera were recorded in the month of October while the lowest (0.75±0.08) and (0.72±0.00) were recorded in the month of September. Highest K (1.58=+0.32) and (1.51 +-0.29) for uninfected male and female were recorded in the month of July. In addition highest K of infected male (1.3+-0.03) and female (1.43+-0.02) for *A. occidentalis* were recorded in the month of October 2017, while the lowest (0.97+-0.01 and 0.94+-0.02) where recorded in the month of September, 2017. Whereas highest k (1.78+_0.35 and 1.73+-0.32) of male and female *A. occidentalis* were recorded in the month of July, 2017 while the lowest (1.10+-0.06 and 1.07+-0.15) were recorded in the month of September, 2017.

Table 4: Monthly mean condition factor of parasitized and non parasitized male and female *S. euptera* and *A. occidentalis* from Lower River Benue

Months	*S. euptera*				*A. occidentalis*			
	Male		Female		Male		Female	
	Infected	Uninfected	Infected	Uninfected	Infected	Uninfected	Infected	Uninfected
July	0.83±0.04	1.58±0.32	0.98±0.00	1.51±0.29	1.05±0.07	1.78±0.35	1.20±0.02	1.73±0.32
August	0.80±0.03	0.88±0.03	1.01±0.00	0.89±0.03	1.02±0.06	1.10±0.11	1.23±0.02	1.13±0.06
September	0.75±0.08	0.88±0.03	0.72±0.00	0.85±0.01	0.97±0.11	1.10±0.06	0.94±0.02	1.07±0.15
October	0.91±0.29	1.27±0.08	1.21±0.00	1.43±0.15	1.13±0.03	1.49±0.11	1.43±0.02	1.65±0.18

Figure 1 shows the results of percentage parasite infestation of infected male and female *S. eupterus* and *A. occidentalis* from Lower River Benue. Female *S. euptera* had higher percentage parasite infestation (55.74%) from 62.55% infected fish samples than the male (44.26%) parasites from 37.5% infested fish. Also, female *A. occidentalis* had higher parasite infestation (65.45%) from 63.16% infected fish than the male with 34.55% parasite infestation from 36.84% infected fish.

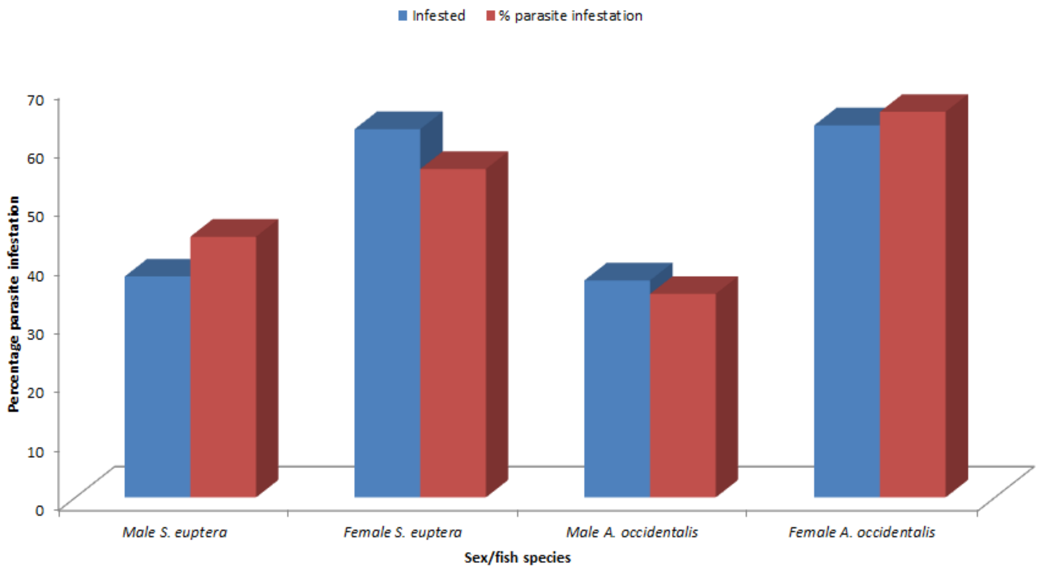

Fig 1: Percentage parasite infestation of infected male and female *S. euptera* and *A. occidentalis* from Lower River Benue

4. DISCUSSION

The study was carried out to investigate the parasitic load of 90 specimens each of *S. eupter* and *A. occidentalis* from Lower River Benue. Three (3) parasites species which include *Eustrongylides sp.,Diphilobothrium latum* and *Coculanus sp.* were recovered from the fish used for the study. *E. sp* and *D. latum* were recovered from the stomach and intestine of the fish samples while *Coculanus sp* was recovered from the intestine only. *E. sp* and *D. Latum* were the highest occurring parasites in the stomach and intestine, while the *E. sp* had a single occurrence which was also the least. However, the intestine had higher percentage parasites than the stomach. This agrees with the studies by Sidney *et al.*, (2014), Obano and Odiko, (2004) and Chanda *et al*., (2011). The large amount of food intake by the fish can also be an underlying factor to the high prevalence of parasites in the intestine. An overall prevalence of 26.67% and 21.11% were recorded for *S. eupter* and *A. occidentalis* with the females having more infection than the males. This contradicts the investigations by Sikoki *et al*., (2013), who reported a higher overall prevalence of parasites and more infections in males than females. However, this work agrees with the reported work of Ekanem *et al.*, (2011). The increased parasitism in females than in males was not statistically significant (p>0.05) and this agrees with the reported work of Sikoki *et al.*, (2013) who reported higher endoparasites in female samples than the male counterparts. This infection pattern may also be due to physiological preference to host specific factors as stated by Sikoki *et al*., (2013).

The low parasitic prevalence in the examined fishes could be attributed to the relatively high sanitary condition of the river brought about by its tidal effect that reduces the concentration of pollutants in the river and the location of the river from the main residential areas.

The size class related prevalence showed an increase in parasitic infections in bigger specimens than the smaller ones. Variation in parasitic prevalence among the various size groups (total length and weight) of the fish samples was observed in the two fish species used for the study. This may be attributed to the random selection of the fish samples that might have favoured the most parasitized samples. Also, variation in parasitic prevalence among the various size groups (total length and weight) of the fish samples may be due to the possibility of repeated infection as the fish grew older. This agrees with the reported studies of Sikoki *et al*., (2013). Bello *et al.*, (2011), *Ekanem et al.*, (2011) and Obano and Odiko (2004).

Exhaustive empirical surveys have shown that, almost without exception, intestinal helminth parasites are aggregated across their host populations, with most individuals harbouring low numbers of parasites, but few individuals playing host to many (Shaw and Dobson, 1995). Heterogeneities such as these are generated by variation between individuals in their exposure to parasitic infective stages and by differences in their susceptibility once an infective agent has been encountered. In the absence of any heterogeneities in exposure, even small differences in susceptibility between hosts can rapidly produce nonrandom, aggregated distributions of parasites (Lafferty, 1997). Sex and host condition factor have been found to be one of these varying factors. The well-being of fish and the population in general can be determined by the analysis of condition factor. Condition factor is a measure of energetics, nutritional status and viability of a host. In this present study, there was not much difference in the range of the weight and length of infected and uninfected male and female individuals of *S. euptera* and *A. occidentalis* with low and high condition factor but, each of these populations showed variation in condition factor. This simply signifies that condition factor is independent on size and weight and could only be used in comparing individuals of same species. In this study, High condition individuals of *S. euptera* harboured more intestinal helminth parasites than low condition individuals and this also applied to individuals of *A. occidentalis*. This agrees with the reported work of Akinsanya *et al.*, (2015).

Within populations, individuals differ in their ability to compete for limited resources (Begon *et al*,1990) and the resulting unequal division of nutrients lead to variation in growth rates, body size and nutritional condition (Westerberg *et al.*, 2004). Unequal nutrient intake by competitors is also likely to have consequences for any parasites they may harbor, though it is difficult to predict the direction of such effects. Since condition factor (K) is a measure of nutritional status in fish, parasite load and intensity among low condition individuals were less than those of their high condition individuals. This shows that these individuals had low nutritional and energetic competence to harbor parasites.

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