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Full Length Research Paper

Prevention of parasites of fresh water shrimp (*Atya gabonensis*) from Rivers in Makurdi

***Olagunsoye F. Rotimi, Fatou B. Dabiri and Toyin F.O**

Department of Fisheries and Aquaculture, Obafemi Awolowo University, Ife, P.O.Box 3340 Nigeria.

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The study investigated the parasitic prevalence of freshwater shrimps (*Atya gabonensis*) in the lower Benue River for a period of six months (March – August, 2012) during which a total of 1000 shrimps were sampled randomly from the landing sites of the River Benue and were analyzed at the parasitology laboratory of the verterinary teaching hospital, University of Agriculture, Makurdi. The gills of shrimps had the highest parasitic prevalence of 50.36% and the intestine with the lowest parasitic prevalence of 5.40%. Shrimps were infected more with ciliates with prevalence rate of 49.37% and less infected with cestodes with prevalence rate of 6.43%. Monthly condition factor shows that in March, April, June and July there was a significant difference(P< 0.05) between male and female, but there was no significant difference (P>0.05) between male and female in May and August. Correlation between weight and infection, total length and infection, weight and total length of *A. gabonensis* shows that correlation between weight and infection r=0.008, total length and infection r=0.007 and correlation between weight and total length r=0.853 and has a significant difference. It was observed that the number of shrimps infected with parasite was associated with sex.

Key words: *Atya gabonensis*, condition factor, parasitic prevalence.

INTRODUCTION

Parasites have been found to affect the population dynamics and community structure of many of their hosts and parasitic associations may cost decrease in the host's nutritional status, condition, growth, fecundity competitive ability and mating success (Bush et al., 2001)

Parasitic diseases are caused by organisms that depend solely on their host deriving their nutrient abide and causing abnormalities and pains. Numerous species of parasites have been described from various shell fish, especially representative of the mollusca and crustacean (Lauckner, 1983; Sparks, 1985; Sindermann and Lightener, 1988; Sindermann, 1990).

Surprisingly, few have proven to cause disease significance to host population. However, some parasites may have the potential if conditions are in their favour. Studies have showed that at high densities, these parasites have been found to cause the mortality in cultured shrimps, leading to severe loss in various parts of the world (Mojit et al., 2010).

There is a tremendous scope for the development of

*Corresponding author. E-mail: ola.bandele@oauife.edu.ng

fresh water shrimp culture in India, but the problems coming from pathogens and disease lead to the huge losses throughout India as well as the world at large (Mojit et al., 2010).

Atya gabonensis have been found to occur in great abundance in Nigeria main rivers and tributaries (Reed, 1967). According to Obande (2006) *A. gabonensis* occur in the lower Benue River in great abundance. Therefore the study of the prevalence of *A. gabonensis* in the lower Benue River is of great concern in order to prevent the adverse effect of parasitic infection in the animal.

Several endo and ecto parasites also affect shrimps at different stages of development. Protozoan genera, such as zoothamnium, Epistylis, Vorticella, Anophrys, Acineta, Lagenophrys and Ephelota, are present in shrimp ponds throughout America and are associated with low water quality. At high levels of infection, these protozoans may induce gill obstruction (brown gill) leading to anorexia, retarded growth, reduced locomotion and increased susceptibility to infection by other viral or bacterial pathogens (Nunan et al., 2004).

Less known parasites, such as haplosoridian described in Cuba in 1988, was found again a decade later in some ponds in Belize where they were causing hepatopancreatic infections in cultured *L.vannamei* (Nunan et al., 2007). Other pathogenic organisms such as microsporidia (Agmasoma Sp. And Ameson Sp.) also affect shrimps but as in the case with endoparasitic protozoans are not usually associated with high mortalities or production losses.

The consumption of shrimps and shrimp products especially in raw or uncooked form leads to the consumption of live parasites they may contain. A number of parasites with larval stages in fresh water and marine shrimps have zoonotic potential if eaten raw or lightly cooked thus consumption in this form predisposes to zoonosis (Meyer, 1970). Theincreasing tendency of eating shrimps, crabs, meat, fish and mollusks raw, undercooked, smoked pickled or dried facilitates the consumption of a number of protozoan, trematode, cestode and nematode parasites which caused zoonoses (Macpherson, 2005).

The study was aimed at investigating the parasites of *A. gabonensis* in the Lower Benue River and determines if there is any difference in infection rate by sex.

Study area

The study was carried out in the Lower Benue River located in Makurdi and its environs, Benue State of Nigeria. Geographically, Makurdi is found on latitude 7 and 8° North of equator and longitude 8 and 9° east of the Greenwich meridian (Figure 1). It is the second largest river in the country, after River Niger. It originates from Adamawa hills and flows from the southern part of Cameroon through Makurdi and southwards to Lokoja where it forms a confluence with River Niger, from where it discharges into the Ocean. The river consists of a series of braided channels of different sizes which meander across the floodplain. The flood plain also contains seasonally inundated depression, known as Fadama, these provide important fishery resources, which are exploited after the flood has receded. These are a lot of fishing activities for finfish and shellfish, such as shrimps and prawns, in the lower Benue River.

MATERIALS AND METHODS

A total of 1000 shrimps were collected fourth nightly for a period of six months from March to August, 2012. The shrimps were obtained from local fishermen using baited traps. The shrimps were transported from the landing site inside a bucket containing Benue River water to the Parasitology Laboratory of the Veterinary Teaching Hospital University of Agriculture Makurdi. The Shrimps were placed on the dissecting board and were given serial numbers first, then, bio-data was collected from each which includes:

1. Length measurement (cm) using a meter rule;
2. Body weight (grams) using a sensitive mettle weighing balance.

Sex of each specimen was determined by examination of the abdominal segment (swimmerets). The female has a pair of ovaries. Eggs produced in each ovary pass through a delicate oviduct to a genital pore at the base of the third walking leg. While the male has a pair of testes from each a vas deferens carries sperm to an opening on the genital papilla at the base of each fifth walking leg:

1. The sex ratio of the shrimps was determined by counting the number of male and female specimens caught in the period of study and was calculated using sex ratio formula.
2. Sex ratio = M:F, where M = Male, F = Female (If number of male = n and number of female = ×).
3. Sex ratio M:F = n/n : ×/n

Examination of *A. gabonensis* for collection of parasite

The Exoskeleton, gills legs, was examined with a magnifying lens. The exoskeleton was washed thoroughly using a tooth brush. The water from the washed was poured in a test tube and centrifuged, using an ordinary centrifuge at 4500 rpm for 5 min. The supernatant was decanted and the sediment examined under a light microscope.

The parasites were identified by making their sketches as observed on the light microscope and compared with the pictorial guide on fish parasites by Pouder et al. (2005) the parasites observed on the light microscope were counted, recorded and photographed using a digital camera.

Data analysis

T-test was used to determine the difference between the condition factor of the infected and uninfected fishes. Correlation metric was used to determine the relationship between weight/length and the infected species. Chi – square was used for differences in parasite load in sex. ANOVA was used for significant difference in infection between months.

Figure 1. Map of River Benue Showing Landing Sites for *A. gabonensis*. ●, Landing sites.

RESULTS

Majority of the parasites were found on the gills. Gills had the highest parasites prevalence of 49.35%, followed by 30.57% on the exoskeleton, 14.69% in the intestine and 5.40% in the faeces. Ciliates had the highest prevalence of 49.37% followed by Nematodes 36.75%, Flagellates 7.47% and Cestodes 6.43% (Table 1).

Table 2 shows the parasitic prevalence statistics from March to August, 2012 and Figure 2 showing the monthly distribution of Parasite on organs of *A. gabonensis.* Also in the monthly condition factor of male and female shrimps (Table 3), it shows that in March, April, June and July there was significant different (P<0.05) between the male and the female. There is no significant difference (P>0.05), between male and female in May and August. When comparing the condition factor of infected and uninfected shrimps (combined sex), there was no significant difference (P>0.05) as shown in Table 3.

For the male *A. gabonensis,* there is no significant difference (P>0.05) between infected and uninfected male. Also for the female *A. gabonensis,* there is no significant difference (P>0.05) between infected and uninfected female as shown in Table 4.

Correlation matrix of the number of parasite and mophometric characteristics of female *A. gabonensis* shows correlation between weight and infection r=0.059, total length and infection r=0.026 and correlation

Table 1. Distribution of the parasites in the organs of *Atya gabonensis.*

Taxonomic group	Species of parasites	Intestine	Exoskeleton	Gills	Faeces	Total No. (%)
Ciliates	*Ichthyophthirus* sp.	-	-	105 (5.45)	-	105 (5.45)
	Tetrahymena sp.	125 (6.49)	140 (7.27)	152 (7.89)	-	417 (21.64)
	Trchodina sp.	-	-	-	104(5.40)	104 (5.40)
	Apiosoma sp.	-	25 (1.30)	175 (10.09)	-	200 (11.31)
	Capriniana sp.	-		125 (6.49)	-	125 (6.49)
Flagellates	*Piscinoodinium* sp.	-	-	144 (7.47)	-	144 (7.47)
Cestodes	*Bothricephalus* sp.	124 (6.43)	-	-	-	124 (6.43)
Nematodes	*Camallanus* sp.	-	140 (7.27)	-	-	140 (7.27)
	Capillaria sp.	-	20 (1.04)	-	-	20 (1.04)
	Procamallanus sp.	34 (1.76)	224 (11.62)	250 (12.97)	-	508 (26.36)
	Philometridae sp.	-	40 (2.08)	-	-	40 (2.08)
Total		283 (14.68)	589 (30.58)	951 (50.36)	104 (5.40)	

Table 2. Monthly Parasitic Prevalence Statistics, March-August 2012.

Parasite	March	April	May	June	July	August
Apiosoma	64	27	34	19	31	25
Bothricephalus	13	21	36	17	18	9
Camallanus	37	38	38	7	11	19
Capillaria	11	9	-	-	-	-
Caprianía	-	-	41	29	37	18
Ichthyopthirus	28	30	27	20	-	-
Philometridae	14	23	3	-	-	-
Piscinoodium	49	43	20	10	14	8
Procamallanus	80	70	76	37	114	131
Tetrahymena	76	32	98	42	81	88
Trichodina	25	19	36	10	9	5
Total	397	312	409	191	315	303

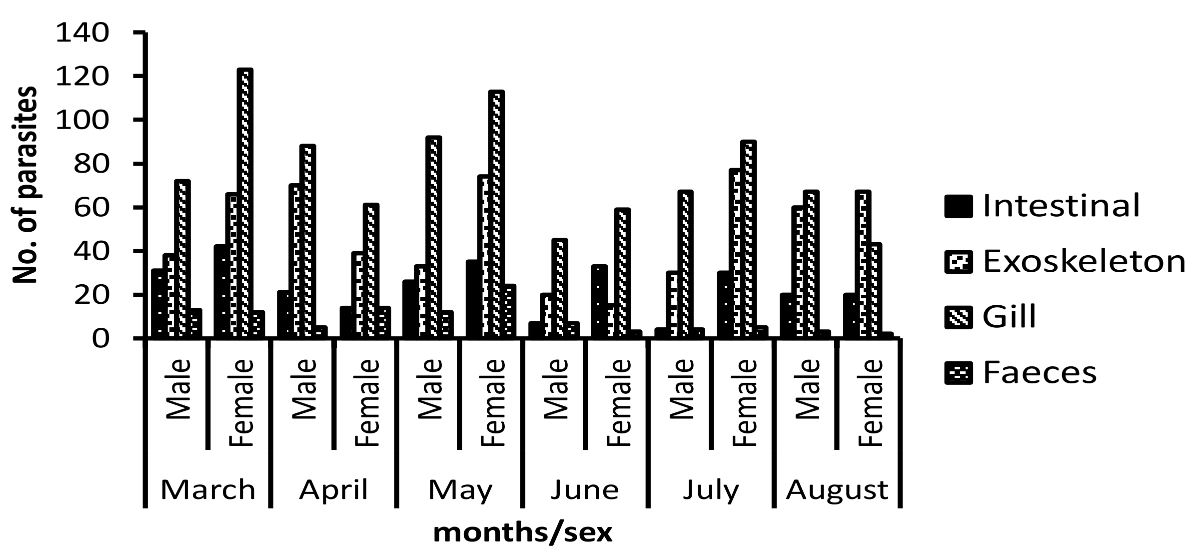

Figure 2. Monthly distribution of parasite on organs of *Atya gabonensis.*

Table 3. Monthly condition factor of male and female shrimps.

Month	Sex		P-Value
	Male	Female	
March	2.387±0.307	2.705±0.079	0.0209*
April	2.47±0.078	3.05±0.089	0.0001***
May	2.99±0.101	3.35±0.275	0.2425^{ns}
June	2.281±0.074	3.73±0.407	0.0017^{ns}
July	2.375±0.036	2.90±0.15	0.0036^{ns}
August	2.615±0.061	2.758±0.066	0.1208^{ns}

***Significant (P<0.01) ; *Significant (P<0.05); ^{ns}Non-significant.

Table 4. Comparison of condition factor of infected and uninfected shrimp.

Sex	Infected	Uninfected	Number of Infected	Number of uninfected	P-Value
Male	2.718±0.069	2.787±0.204	401	87	0.6974^{ns}
Female	3.064±0.094	3.016±0.112	451	61	0.8586^{ns}
Combined	2.903±0.060	.881±0.129	852	148	0.8896^{ns}

^{ns}Non-significant.

Table 5. Correlation matrix of morphometric parameters and number of parasites on female shrimps.

Parameter	Length (cm)	Weight (g)	No. of parasites
Length (cm)			
Weight (g)	0.851(0.000)***		
No. of parasites	-0.026(0.560)	-0.059(0.183)	
K	-0.401(0.000)***	-0.032(0.463)	0.003(0.939)

***Significant (P<0.01). contents: Pearson's correlation (P-value).

Table 6. Correlation matrix of morphometric parameters and number of parasites on male shrimps.

Parameter	Length (cm)	Weight (g)	No. of parasites
Length (cm)			
Weight (g)	0.857(0.000)***		
No. of parasites	0.030(0.507)	0.055(0.227)	
K	-0.249(0.000)***	0.090(0.048)*	-0.026(0.574)

***Significant (P<0.01); *Significant (P<0.05); Contents: Pearson's correlation (P-value).

between weight and total length r=0.851 and has a significance difference at (P<0.01) as shown in Table 5 Table 6 shows correlation of male *A. gabonensis* with correlation between weight and infection r=0.055, total length and infection r=0.030 and correlation between weight and total length r=0.857 and has significant difference (P<0.01).

Correlation between weight and infection, total length and infection, weight and total length of *A. gabonensis* shows that, correlation between weight and infection r=0.008, total length and infection r=0.007 and correlation between weight and total length r=0.853 had a significant different (Table 7).

Table 8, above is a 2 x 2 contingency table that can be subjected to the chi square test. It implies that we reject the null hypothesis and accept the alternative hence, the number of shrimps infected with parasites is associated with sex. Plates 1 and 2 showed the result viewed

Table 7. Correlation matrix of morphometric parameters and number of parasites on all shrimps.

Parameter	Length (cm)	Weight (g)	No. of parasites
Length (cm)			
Weight (g)	0.853(0.000)***		
No. of parasites	-0.007(0.813)	-0.008(0.806)	
K	-0.330(0.000)***	0.024(0.450)	0.009(0.786)

***Significant (P<0.01). Contents: Pearson's correlation (P-value).

Table 8. Infection status in relation to sex of shrimps from Lower Benue River.

Sex	Infection status		Total	x^2	p value x^2(Fisher's exact test)
	Infected	unInfected			
Male	401	87	488	7.58	0.0059** (0.0065**)
Female	451	61	512		
Total	852	148	1000		

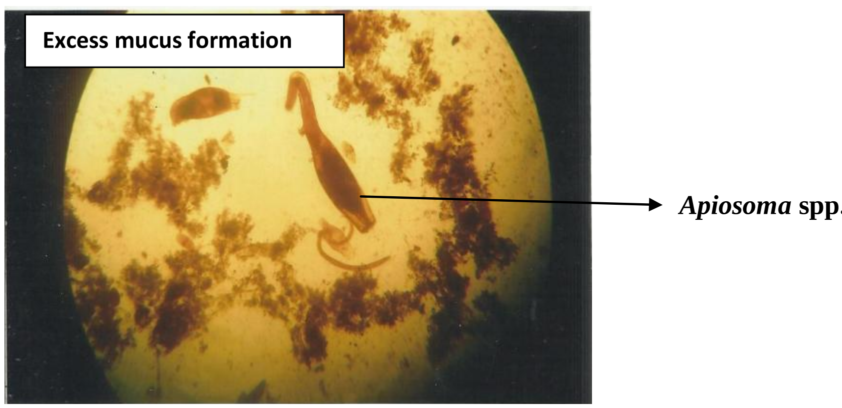

Plate 1. *Apiosoma* spp. on the exoskeleton and gills.

under the microscope.

DISCUSSION

Several parasites (endo and ecto) were observed and identified in *A. gabonensis* used for this work. This is in agreement with the findings of Overstreet (1973), Couch (1978), Johnson (1978) and Fontaine (1985) who reported that shrimps in their natural environment serve as hosts for a variety of parasites groups (nematodes, cestodes, ciliates and flagellates).

Different kinds of parasites were observed to be present in different locations in *A. gabonensis*. They occur in the exoskeleton, and gill *Tetrahymena* species appeared on the gill, exoskeleton and intestine, Piscinoodium species appeared on the gills; *Procamallanus* species appeared on the gill, exoskeleton and gills; *Capriniana* species appeared on gill, *Apiosoma* species appeared on the exoskeleton and gills as seen in Plate 1; Trichodina species appeared on the faeces, *Capillariia* species appeared on the exoskeleton; *Ichthyophthirius multifilis* appeared on the gill (Plate 2); *Bothricephalus* appeared on the intestine. Corliss (1979), Elliott (1973), Morado and Small (1995) have reported parasitic infection in crabs lobster and shrimps.

The present study revealed that *Tetrahymena* species affected the gills, this agrees with the work of Edgerton et al. (1996). They reported that live ciliates (*Tetrahymena* species) were observed in the haemal sinuses of the gills browsing on tissue fragments. Elliott (1973) reported that *Tetrahymena* species are facultative parasites with infections being accidental or opportunistic in nature. Ciliates are thought to gain entry to the host tissue through lesion or injuries in the external surfaces of the Gills were also observed to habour the highest number

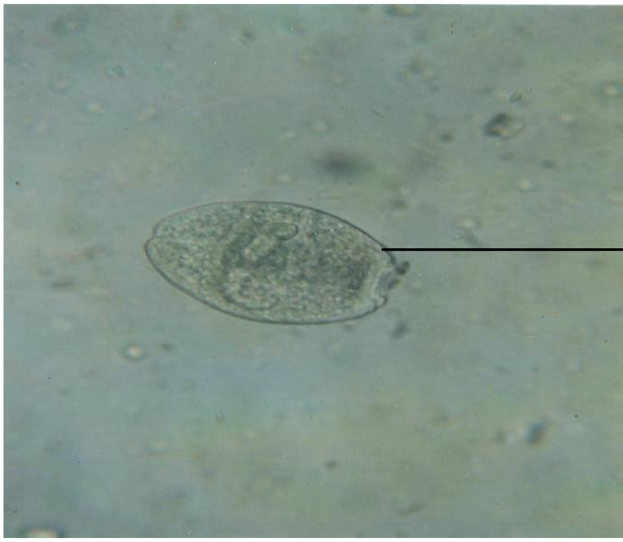

Plate 2. *Ichthyophthinus* species on the gill.

of parasites. This could be because the gills are the center of filter feeding and are the sites of gaseous exchange. According to Roberts and Sumerville (1984), the sieving ability of the gill rakes may help to trap some organisms and this could be contributed to the presence of the parasite there. Infection in the gills caused severe degeneration, necrosis and consequent degradation of the bronchial epithelium and occlusion of the capillaries. Infection also induced massive proliferation of chloride and mucus cells and also caused hyperplasia of the lining filamental epithelium. However, degradation of the epithelial layer was either limited in extent or occurred in an uneven pattern. This observation was explained in the reported work of Paperna and Van (1983) which stated that the epithelial degradation was counteracted by the extreme process of epithelial hyperplasia.

Infection with *Tetrahymena* species caused removal of the epithelium and excess mucus production so that the fin and gills of infected fishes were covered in a thick layer of mucus, in which were contained the ciliates. This agreed with the reported work of Obiekezie and Ekanem (1995).

Conclusion

The result of these findings concluded that parasites of *A. gabonensis* in fresh water were not too different from other aquatic organism (fish species). The effects of this parasites on shrimp and other fish was varied depending on the intensity of the infection, site of infection and havocs cause by the parasite which also reflected on their mean condition factor.

Damaged done by the parasites on shrimps may be considered for further studies.

Conflict of Interest

The author(s) have not declared any conflict of interests.

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