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Preliminary Studies on the Culture of *Atya crassa* in Outdoor and Indoor Tanks

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ABSTRACT

Atya crassa like its relative *Macrobrachium* species can be a source of foreign exchange for Nigeria. The *Atya crassa* was cultured in indoor and outdoor rearing systems to investigate the possibility of its growth and production in captivity. *A. crassa* of sizes ranging 7.05±0.13-8.5±0.05 g were purchased from fishermen around the Jebba Lake. They were transported in open Jerry cans in a cold van for about 2 h. The indoor tanks measured 3×2×1.5 m and were stocked 17 prawns per tank while the outdoor tanks were 2×2×1.5 m and stocked 10 prawns per tank. The experimental diets were formulated with crude protein levels 30, 35 and 40%. Each diet was assigned to two tanks each indoors and outdoors. They were fed twice daily (9 and 19 h) for 184 days. Positive growth was observed in both indoor and outdoor tanks. There was no significant difference in the growth of prawns fed outdoor ($p>0.05$) while there was significant difference indoors. The percentage survival of prawns was higher outdoors and there was no significant difference ($p>0.05$) while there was significant difference ($p<0.05$) in the survival indoors. The carcass composition of *A. crassa* fed the three diets showed crude protein lower at harvest than the prawns stocked initially. Percentage lipid, ash and fibre of the harvested prawns were higher than at initial stocking. *A. crassa* is cultivable in freshwater and it should be reared with 30% crude protein diet in outdoor systems.

Key words: *Atya crassa*, survival rate, growth parameters, proximate analysis, protein diet

INTRODUCTION

Crustaceans in general and shrimps in particular, are high value aquatic food commodities globally (Kutty *et al*., 2009). *Macrobrachium rosenbergii* culture has progressed rapidly since 1999 to reach 42, 780 t and 43, 395 ha in 2006 in South East Asia (Kutty *et al*., 2009); in Brazil production increased from 40,000 to 60,128 t during the period 2001-2002 (Gustavo and Jose, 2009). Marioghae (1986) stated that there is potential for the culture of Nigerian palaemonid prawns of the genus *Macrobrachium vollenhovenii* and *Macrobrachium macrobrachion*. According to Marioghae (1986) these prawns require some saline water. Sagi and Aflalo (2005) stated that the growth of *M. rosenbergii* in culture systems may be affected by a wide variety of factors, such as gender, sexual maturity and age (Hartnoll, 1982; Botsford, 1985; Aiken and Waddy, 1992). Hartnoll (1982) observed that a number of crustacean species exhibit superior growth pattern in which males exhibit superior growth to females. Sagi and Aflalo (2005) reported better growth for all-male population compared to all-female population of *M. rosenbergii*.

Feed cost is estimated to amount to 13-27% of the cost of production of shrimps. Antiporda (1986) reported that research on nutrient requirement of shrimps is scarce and the few available resulted in wide variations. *A. crassa* culture has not been attempted as there was no available literature. *Atya gabonensis* available in the lower Benue river is a close species to *A. crassa* and studies on it was on length-weight relationship and condition factor (Obande, 2008). There has been no previous study on the rearing of this species. This study attempted to rear *A. crassa* in indoor and outdoor tanks with varying levels of protein.

MATERIALS AND METHODS

Transportation and stocking: *A. crassa* of sizes ranging 7.05±0.13+8.5±0.05 g were purchased from fishermen around the Jebba Lake. They were transported in open Jerry cans in a cold van for about two hours. On arrival at the culture area fresh water was added to the Jerry cans to dilute the heavy load of ammonia that has accumulated throughout the journey. The prawns were sorted out into sized and dead ones were separated.

The indoor tanks measured 3×2×1.5 m while the out door tanks were 2×2×1.5 m. The indoor tanks were stocked 17 prawns per tank while the outdoor tanks were stocked 10 prawns per tank. They were acclimated for seven days. The tanks were aerated with a 2 Hp blower throughout the period of the experiment.

Feed and feeding: The experimental diets were formulated with crude protein levels 30, 35 and 40%. The ingredients used were fishmeal, palm kernel cake, guinea corn, starch, calcium carbonate and these were fortified with premixes (Table 1). Each diet was assigned to two tanks each indoors and outdoors. They were fed twice daily (9 and 19 h) for 184 days. The initial weight of the prawns was measured at stocking. After the feeding commenced bulk weighing was done monthly.

Proximate analysis: Proximate composition of the ingredients for formulation of feed was carried out (AOAC, 2000) (Table 2). Samples of *A. crassa* were analyzed before and after the experiment for each treatment (AOAC, 2000).

Table 1: Proximate composition of ingredients

	Composition (%)					
Ingredients	Moisture	Protein	Lipid	Fibre	Ash	NFE
Palm kernel cake	3.93	9.29	9.30	19.00	4.04	54.44
Fish meal	4.95	63.44	21.95	0.80	11.49	Nil
Guinea corn	6.93	11.17	17.10	1.60	2.18	61.02

NFE: Nitrogen free extract

Table 2: Percentage composition of ingredients in diet

Ingredients	Diet I (30% crude protein)	Diet II (35% crude protein)	Diet III (40% crude protein)
Fish meal	290.00	387.20	484.40
Palm Kernel cake	325.00	276.40	227.80
Guinea corn	325.00	276.40	227.80
$CaCO_3$	10.00	10.00	10.00
Starch	30.00	30.00	30.00
Premix	20.00	20.00	20.00

Statistical analysis: Statistical analysis was done using computer package SPSS version 10. Significant differences in means were measured using one-way Analysis of Variance (ANOVA) and Duncan's multiple range test.

Measurement of growth parameters: The growth parameters were calculated as follows:

$$\text{Mean weight gain (MWG)} = \frac{\text{Wt-Wo}}{\text{Wo}}$$

$$\text{Specific growth rate (SGR) (\%/day)} = \frac{\text{ln Wt-ln Wo)}}{\text{t}} \times 100$$

$$\text{Feed conversion efficiency (FCE)} = \frac{\text{Weight gain (g)}}{\text{Dry food intake}}$$

RESULTS AND DISCUSSION

Positive growth was observed in both indoor and outdoor tanks. There was no significant difference in the growth of prawns fed outdoor ($p>0.05$). There was significant difference in the growth parameters of prawns fed the varying diets indoors. The percentage survival of prawns was higher outdoors and there was no significant difference ($p>0.05$) in the survival recorded in the three treatments. There was significant difference ($p<0.05$) in the survival of prawns in indoor tanks. Summary of results are shown in Table 3.

A. crassa fed the three diets indoors showed significant difference ($p<0.05$) in all growth parameters. The growth of prawns fed diet III was better in terms of weight gain. The specific growth rate and food conversion efficiency showed that diet II and III had a superior and equal growth than diet I (Fig. 1). This result varies from the report on *M. rosenbergii*, where there was no significant difference in the four treatments provided (Fujimura and Okamoto, 1970) and Balazs and Ross (1976) found each protein source having greater growth with increasing level of protein while Boonyaratpalin and New (1980) found no significant difference in the growth of three protein levels fed. This study compares well with Antiporda (1986), where all variables considered showed significant variation.

The outdoor experiment showed no significant variation ($p>0.05$) in all growth parameters of prawns fed various diets. This result was similar to Fujimura and Okamoto (1970) and Boonyaratpalin and New (1980) while it varies from the observations by Antiporda (1986) and Balazs and Ross (1976).

Table 3: Growth and survival of *A. crassa* in indoor and outdoor tanks for 184 days

	MIW	MFW	MWG	FCE	SGR	Survival
Indoor						
Diet I	8.12±0.16	9.85±0.33^{a}	1.78±0.27^{a}	0.04±0.01^{a}	0.11±0.02^{a}	43.00±6.93^{c}
Diet II	7.05±0.13	9.77±0.00^{a}	2.72±0.13^{ab}	0.07±0.00^{b}	0.18±0.01^{b}	86.20±13.51^{bc}
Diet III	8.43±0.08	11.59±1.12^{b}	3.26±0.73^{b}	0.07±0.02^{b}	0.18±0.03^{b}	68.64±3.40^{b}
Outdoor						
Diet I	8.32±0.13	11.81±1.46^{b}	3.29±0.97^{b}	0.07±0.02^{b}	0.18±0.04^{b}	96.67±5.77^{c}
Diet II	8.27±0.15	10.34±0.62^{ab}	2.26±0.40^{ab}	0.04±0.01^{a}	0.12±0.02^{ab}	100.00±0.00^{c}
Diet III	8.50±0.05	11.47±1.11^{b}	3.02±1.08^{ab}	0.07±0.03^{b}	0.16±0.05^{ab}	100.00±0.00^{c}

All values with the same letters in the same column are not significantly different, MIW: Mean initial weight, MWG: Mean weight gain, MFW: Mean final weight, FCE: Food conversion efficiency, SGR: Specific growth rate

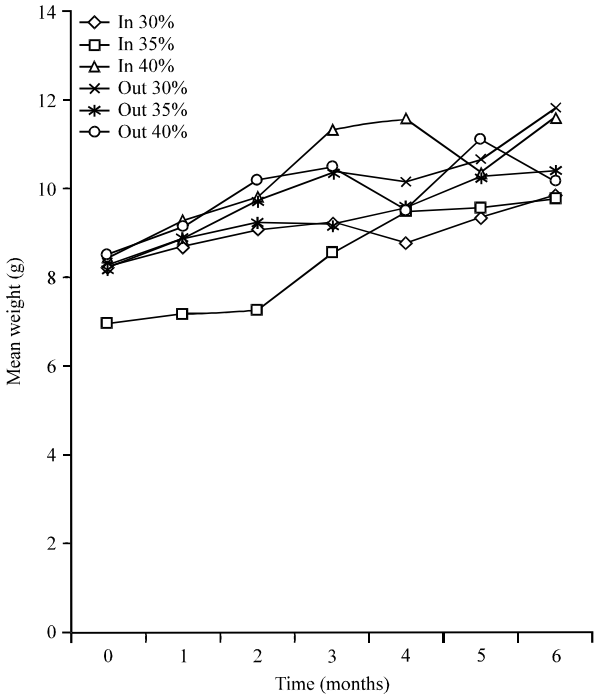

Fig. 1: Growth of Atya crassa in indoor and outdoor tanks for 184 days using varying levels of protein

In comparing the growth of prawns in both indoor and outdoor tanks there was significant difference ($p<0.05$) in all growth parameters. It was observed that the growth of prawns fed diet II and diet III indoors is the same as that fed diet I outdoors in terms of SGR and FCE. From the foregoing the recommendation of Antiporda (1986) becomes relevant that in outdoor tanks the lower levels of protein was suitable due to high level of natural food. Further to this Coyle *et al.* (2003) reported that prawns may be able to adjust to reductions in the nutritional value of prepared diets (i.e., protein source and vitamin content) by increasing predation on natural fauna (i.e., macro invertebrates) in the pond. In a situation where they cannot locate feed, Coyle *et al.* (2003) reported that prawns would increase consumption of available vegetation to adjust to reduction in the nutritional value of prepared diets. This may be a likely occurrence in this current study.

Figure 1 shows *A. crassa* fed diet containing 30 and 35% indoor had the same growth at harvest while outdoor the same scenario occurred with prawns fed 30 and 40%. During the 4th and 5th months of rearing the slight drop in growth of prawns fed 40% indoor and outdoor was due to mortality and moulting activity, respectively.

The carcass composition of *A. crassa* fed the three diets (Table 4) show crude protein lower at harvest than the prawns at initial stocking. This showed that the somatic increase in size does not necessarily result in increase in protein content. Percentage lipid, ash and fibre of the harvested prawns were higher than at initial stocking. The percentage moisture was lower at harvest than at initial stocking except for prawns fed diet II (35% c.p.) indoors. The NFE was higher at harvest than at initial stoking except for prawns fed diet I (30%) outdoors.

Table 4: Carcass composition of *A. crassa* in indoor and outdoor tanks fed with varying levels of protein

	Composition (%)					
	Moisture	Protein	Lipid	Ash	Fibre	NFE
Indoor						
Diet I	60.50	17.80	10.45	7.80	3.40	0.05
Diet I	65.40	12.66	10.20	5.94	4.30	1.49
Diet I	61.85	16.33	10.35	7.60	3.40	0.47
Outdoor						
Diet I	59.45	17.42	10.65	8.60	3.90	Negligible
Diet I	60.60	15.99	10.09	9.60	3.70	0.02
Diet I	60.75	14.77	11.85	8.80	3.50	0.33
Initial	64.10	20.02	5.92	6.80	3.30	Negligible

NFE: Nitrogen free extract

In outdoor experiment the survival was higher than the prawns reared indoor. The percentage survival of prawns in the indoor tanks varied significantly ($p<0.05$) while those outdoor did not. This could be attributed to higher natural food availability in the outdoor tanks.

In conclusion, *Atya crassa* accepts artificial feed and can survive culture conditions. Further studies on the protein requirement expanding the levels of protein beyond that presented in this study should be carried out.

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