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STUDIES ON EFFECT OF CLAW-ABLATION ON GROWTH AND SURVIVAL OF *Macrobrachium rosenbergii* (De Man)

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Abstract: Sexual dimorphism and differential growth rate is evident in *Macrobrachium rosenbergii* and one of the major hurdles in the uptake of commercial farming. Two of the main difficulties for communal culture of many crustaceans are cannibalism and the social suppression of the growth. But crustaceans are blessed with 'Autotomy; regeneration of organs'. There was a statistically significant difference among treatments due to added substrates. Added substrates produced 41% higher survival and significant increase in average prawn weight ($P < 0.05$). In the second phase, the identified substrate i.e., baked earthen pipe was selected and study was continued to evaluate the optimum stocking density. The different stocking densities tried were $30/m^2$ as control and as treatments $40/m^2$, $50/m^2$ and $60/m^2$. There was no significant ($P > 0.05$) interaction between stocking density and presence of added substrate, but there was significant change in the growth rate among treatments. Stocking density of $40/m^2$ proved to be better with the higher mean weight of 19.20 ± 0.35 g in 90 days of rearing. This study revealed that baked earthen pipe is a better substrate to increase the survival and growth rate of juvenile of *M. rosenbergii* both in the nursery and grow out phases, even at a high stocking density of $40/m^2$.
Keywords: Claw ablation, Stocking Density, growth and survival, *Macrobrachium rosenbergii.*

Introduction

Two of the main difficulties for communal culture of many crustaceans are cannibalism and the social suppression of the growth. Due to cannibalism, crustaceans raised in groups have a lower survival rate than those raised in isolation. Social suppression appears to underline the differential growth rate of individuals in communal culture. This is usually the result of a reduction in the growth rate of the smaller individuals, unlike in isolated controls (Stewart and Squires, 1968; Mc Leese, 1972; Van Olst et al., 1980; Cobb et al., 1982; Kendall et al., 1982; Lee and Fielder, 1983). Both cannibalism and social suppression of growth may be influenced by

the retention or absence of claws, the tools employed by many crustaceans in predation and aggression. Aggression seems to be involved in the following major mechanisms suggested as social controls of growth in crustaceans;

1. ***Direct competition for food:*** Aggressive and dominant individuals deprive subordinates (i.e. smaller individuals) for food (Segal and Roe, 1975). This hypothesis is supported by the observation that reduction in the supply of food to isolated crustaceans resulted in a decrease of their growth rate (Stewart and Squires, 1968; Chitteleborough, 1975).
2. ***Appetite suppression of subordinate individuals*****:** Agonistic interactions could result in the establishment of a size hierarchy, in which subordinates grow less rapidly, even in the constant presence of food, as a result of lower food intake (Cobb et al., 1982).
3. ***Decreased food conversion efficiency*****:** Smaller subordinate individuals may have low food conversion efficiency. Increased lipid and carbohydrate synthesis was found to occur in suddenly crowded juvenile *Macrobrachium rosenbergii* at the expense of the protein synthesis (Pierce and Laws, 1982). Such a shift over a long period of time could result in reduced somatic growth of suppressed individuals.

In order to reduce the cannibalism and to increase uniform growth, various experiments have been carried out on complete or partial claw-ablation or claw immobilization in the American lobster, *Homarus americanus*. Claw-ablation resulted marked increase in survival and uniform growth in communally raised lobsters (Aiken and Young-Lai, 1979, 1981; Kendall et al., 1982).

The giant freshwater prawn *M. rosenbergii* has two pairs of claws; the first small pair is used for cleaning, in capturing small items of food and transporting them to mouth, and the second large pair is mostly used by both the sexes in predation and inter and intra specific aggression, and by males in predating females (Peebles, 1979).

Survival among claw-ablated prawns was twice as high as that for the two control groups. Intact prawns weighed more than those with the ablated appendages. During the experiment the coefficient of variation of mean weight decreased in the claw-ablated group. It increased in the intact prawns and was relatively stable in the group with ablated first pair of walking legs. The biomass of the claw-ablated group doubled within the test period while that of the controls was stable because the gain in mean weight and the mortalities counterbalanced each other.

Materials and Methods

The experiment was designed to test the effect of claw-ablation on growth and survival by comparing mean weight; change in the Coefficient of Variance of mean weight; biomass and survival of the prawns when they were reared communally. To accomplish this, experiments in triplicates for 120 days.

The experiment was conducted in cement cisterns of 4 m^2. Cisterns were provided with 6 inches soil bed and dried for a week. The experiment was to identify the effect of claw-ablation and hence compared with normal ones for their growth rate. Water was drawn from the nearby reservoir. Prior to filling with water to a depth of 1m initial manuring was done with raw cow dung, urea and single super phosphate at the rate of 500 kg ha-1, 20 kg ha-1, and 40 kg ha-1 respectively. Subsequent manuring was done fortnightly once at a rate of half of the dose of initial manuring. A week later, hatchery born post larva of M. rosenbergii weighing 0.30± 0.018 g were randomly selected and stocked @ 4 PL/m2. The test group consisted of prawns whose second pair of claws was ablated on the 60th day of culture.

Each of the experimental tanks was provided with four earthen pipes of size 60 cm length, 12 cm diameter as shelters. Every fortnight, water quality parameters and prawn sampling was carried out. On sampling days, collection and analysis of water was carried out between 0900-1000 h., prior to the addition of fortnightly dose of manure and fertilizers. Every day air and water temperature was also recorded at 0900-1000 h.

Feeds and feeding

During first fortnight of the experiment, post larvae were fed with microencapsulated commercial diet 'EPIBIOL 500'-500 micron granule having crude protein minimum 49%, crude fat minimum 18%, crude fiber maximum 4% and moisture max 10%. Prawns were fed to satiation twice daily. Later, they were fed with laboratory-formulated feed having 32% protein. It was fed initially @ 5% of the body weight, later reduced to 3%. Daily required feed was fed in two rations i.e., 40% in 0930 h and 60% in 1600 h.

Water quality

Water samples were collected from surface and analyzed for dissolved oxygen (DO), free carbon dioxide (CO_2), pH and total alkalinity. Dissolved oxygen was measured by the standard

Wrinkler's method. Free carbon dioxide and alkalinity were estimated according to the American Public Health Association (APHA, 1976) and American Water Works Association (AWWA, 1976 b). The pH was measured by a digital pH meter (pHep, Henna instruments). All water quality parameters were analyzed within four hours of collection of samples.

Growth of Prawn

Prawns were sampled every fifteen days. Fifty percent of the prawn population was collected and weight was recorded. To know the effect of treatment on length, morphometric measurements were taken using slide calipers. All the prawns were collected at the end of the experiment by draining the cisterns. Non-parametric tests like Mann-Witney test and Wilcoxon tests were employed for statistical analysis of growth data to understand the effect of different treatments on growth of prawn at 5% confidence level. Prawn survival, total biomass production, net biomass production and specific growth rate were calculated.

Results

Table 1. Morphometric measurements of prawn in different treatments

Treatments	**CO**				**AB**			
Morphometry	**FL**	**BL**	**Width**	**Weight**	**FL**	**BL**	**Width**	**Weight**
R1	10.5	5.8	1.4	15.32	16.4	8.2	3.2	24.10
R2	12.2	6.0	1.8	18.50	15.6	8.0	2.9	23.85
R3	13.5	7.5	2.4	19.40	13.8	7.0	2.2	20.70
R4	11.0	6.5	2.0	16.45	14.0	7.2	2.4	21.55
R5	11.2	6.2	1.9	17.33	14.9	7.8	2.8	23.80
Mean	11.68	6.4	1.9	17.40	14.94	7.64	2.7	22.80

Figure 1. Graphical representation of means of morphometric measurements in different treatments

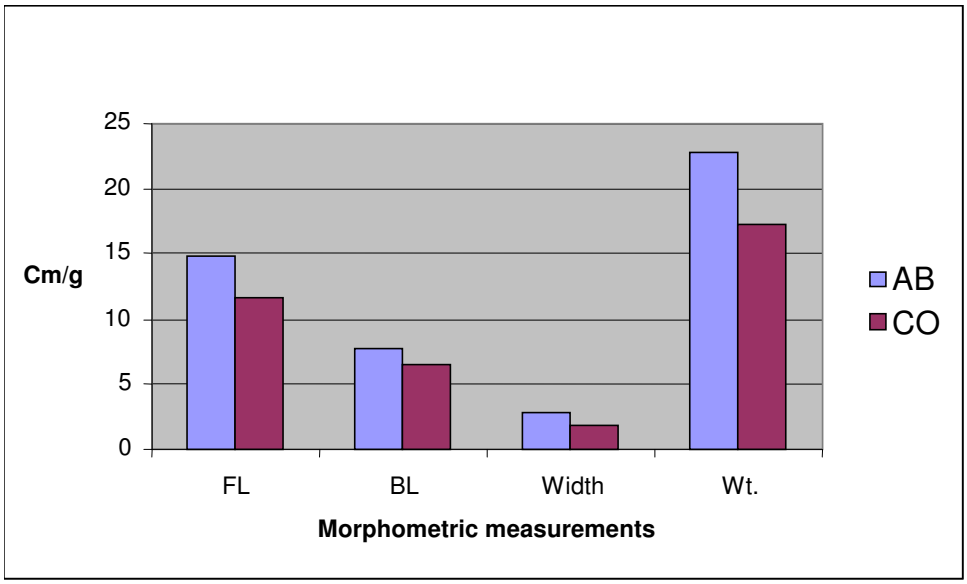

Table 2. Mean growth and survival of juveniles of *Macrobrachium rosenbergii* under different treatments on sampling days

Tr.	**Sampling days**									Sur. %	Prodn. kg ha^{-1}
	0	**15**	**30**	**45**	**60**	**75**	**90**	**105**	**120**		
CO	0.30 ±0.018	2.62	5.90	7.10	9.50	11.00	13.4	15.60	17.4	38.30	266.56
AB	0.30 ±0.018	2.86	5.65	7.60	9.90 **(Ab)**	11.20	16.25	19.40	22.80	68.75	627.00

Tr.: Treatment, Sur %: Survival Percent, Prodn.: Production, CO: Control, AB: Ablated treatment.

Table 3. Mean weight at harvest, production, survival, feed conversion ratio (FCR), daily yield for 120 days of culture.

Variable	Treatments	
	Without claw ablation	with claw ablation
Harvest weight (g)	17.40±0.73 [a]	22.80±0.69 [b]
Production (kg ha $^{-1}$)	266.56±11.0 [a]	627.00±20.0 [b]
Survival (%)	38.30 [a]	68.75 [b]
Daily yield (kg ha $^{-1}$ day^{-1})	2.22 [a]	5.22 [b]
FCR	2.8±0.1 [a]	2.3±0.1 [b]

Discussion

Due to certain constraints such as shortage of quality seeds and differential growth rates, freshwater prawn farming in the country has not spread to the extent it deserves. The virtual collapse of shrimp farming due to viral disease out breaks, the ban imposed by the Supreme Court for shrimp culture in the Costal Regulation Zone (CRZ) and the persistent decline in profitability of carp culture in recent years has forced the aquaculture entrepreneurs to look for an equally remunerative alternative species. The giant freshwater prawn is a profitable and viable alternative species.

In India too, it has gained importance as an aquacultural crop. Production of quality seed is no more a problem due to the advent of new techniques and methodologies in prawn hatcheries. But, problem of differential growth which is also known as heterogenous individual growth (HIG) is still continued to be a major problem in scampi culture. Males of *M. rosenbergii* grow faster and reach higher weights at harvest than females. Hence, culture of all-male population is desirable since sexual dimorphic growth patterns are common among decapod crustaceans. To overcome this problem, many techniques like monosex culture, size grading, production of neomales and different management techniques were adopted in freshwater prawn

farming. In monosex culture almost half of the population is discarded and production of neomales is expensive and continuous process. Size grading is also periodical and laborious.

The wide range of sizes of sexually mature prawn populations and particularly of the males is very typical of *M. rosenbergii* (De Man) and a major obstacle to increased profitability of prawn culture.

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