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Study on Growth and Survival of Giant Freshwater Prawn, *Macrobrachium rosenbergii*, in Tarai Agroclimatic Regime of Uttarakhand

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Abstract: *Giant freshwater prawn, Macrobrachium rosenbergii, is a high value cultured aquatic species, commonly called as 'scampi' in trade circles. An experiment was conducted at Instructional Fish Farm of the College of Fisheries, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar in four rectangular earthen ponds each of the size of 0.033 ha in tarai agroclimatic regime of Uttarakhand. The stocking of PL 10 was done @ 60000/ha. The pre-stocking management of the ponds included dewatering, drying, liming, organic manuring and watering of ponds. The water quality parameters were monitored regularly. The larvae were fed with starter feed upto 60 days of rearing when the larvae attained average weight of around 4g. Thereafter, juveniles were fed with grower feed @ 5% body weight twice a day in two equal splitted doses. The sampling of the prawn was done at fortnightly intervals. The average weight of the prawn at the time of stocking was 0.04g while after 180 days of culture at the time of harvesting the prawn attained average weight of 25.37 ± 14.21g with 76.95% survival. The average absolute growth rate of 0.140 g/day and specific growth rate of 1.55% was achieved during the experimental period. The calculated gross production of 1183.159 kg prawn/ha/crop of 180 days was obtained. The result of the study inferred that the culture of giant freshwater prawn, M. rosenbergii, is feasible in tarai agroclimatic regime of Uttarakhand. The fish farmers of the area can earn their sustainable livelihood through scampi farming.*

Keywords: *Macrobrachium rosenbergii*, Growth, Survival, Production.

Introduction

Freshwater prawn is a highly priced commodity among the freshwater aquaculture species and share a large amount of total aquaculture production. About 200 species of *Macrobrachium* are found all over the world, of which 30 species abound Indian waters. The most important culturable species of genus *Macrobrachium* is *rosenbergii*. This prawn is commonly called as scampi in trade circles. In nursery ponds, stocking density varies from 200 to 400/m^2. However, farmers generally adopt a moderate stocking density of 50 to 100/m^2 without any aeration and water circulation. After 30–40 days of culture in nursery ponds the juveniles are transferred to grow-out ponds with varying stocking density of 5-10/m^2. Most farmers, stock at a moderate stocking density of 6/m^2 under semi-intensive type of monoculture system. *Artemia* is most preferred food of prawn larvae. Formulated pelleted feeds are usually given in grow-out culture twice daily at the rate of 3–5% of the biomass in feeding trays. Recently, farming of *M. rosenbergii* had been concentrated in maritime states due to ready availability of stocking material i.e. post larvae. But, it has also got entry into inland areas where brackish or saline soil or water is available. Tarai region is a unique agro-climatic zone where underground water level is very high and climate is hot and humid. There is no record of giant freshwater prawn farming in this region. In India, culture of giant freshwater prawn at stocking densities of 30000–50000/

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ha has shown production levels of 1.0–1.5 t/ha in a culture period of 6-8 months (Ayyappan, 2007). In the first feasibility study of rearing *M. rosenbergii* in South African inland ponds in 1981, promising yield of 1.2 t/ha was obtained in 172 days, with survival at 76% and a mean weight of nearly 29g (Taylor *et al*., 1992). Culture of the giant freshwater prawn, *Macrobrachium rosenbergii*, has drawn the attention of aqua-culturists and fish farmers in many parts of the world because of its fast growth, adaptability to the poly-culture environment and artificial feed, greater disease resistance than its marine counterparts and high market demand. The popularity of this species has resulted in receiving the increasing attention of researchers in search for innovative culture technology (New, 2002). Various types of shelters/hideouts like PVC pipes, earthen pipes, aquatic weeds and used tyres have been used in prawn culture ponds. The present investigation is aimed to assess culture feasibility of *Macrobrachium rosenbergii* in tarai region of Uttarakhand, including study on survival and growth performance of scampi under semi-intensive monoculture in earthen ponds.

Materials and Methods

The experiment was carried out for a period of 180 days from 28th May to 25th November, 2011 at the Instructional Fish Farm of the College of Fisheries, G.B. Pant University of Agriculture and Technology, Pantnagar. The climatic condition of Pantnagar is humid, sub tropical and is characterized by hot dry summer and extremely cold conditions. The study was carried out in the four outdoor earthen rectangular ponds (P_1, P_2, P_3 and P_4) of size 23m x 14.35m x 1.2m. Supply of water was ensured through a tube well oxygenated water to maintain average water depth of 0.80 ± 0.10 m throughout the experimental period. The ponds were dewatered, dried and liming was done @ 500kg/ha followed by initial manuring @ 2500kg raw cattle dung /ha. The used tyres and broken PVC pipes were used as hide-outs as shelter for prawns. Healthy stock of *M. rosenbergii* was procured from CIFE-sub centre, Rohtak, Haryana. The PL 10 was packed in oxygen filled polythene bags having 1000 larvae. The sealed polythene bags were kept in carton boxes. Transportation was done through road. The seed was properly acclimatized and stocked at the rate of 60000/ha (2000/experimental pond of 330 m^2). Supplementary feeding was done with starter feed (30% protein) and grower feed (26% protein) @ 5% body weight of the prawn twice a day in the two equal splitted doses during late morning and late afternoon. Prawns were sampled fortnightly for growth and health monitoring. The analysis of pond sediment viz. soil pH, soil organic carbon, total nitrogen, available phosphorus, available potassium and soil texture was done. The water quality parameters viz. water- temperature, pH, dissolved oxygen, free CO_2 and total alkalinity in ponds were monitored regularly. The quantitative and qualitative analysis of plankton was also done. The average weight of prawn was measured at fortnightly intervals by using hide-outs or by netting out prawn in equal numbers from each pond and weight of each prawn was measured separately. Absolute growth rate (g/day) was evaluated by using the following formula given by Wood *et al*. (1983).

$$\text{Abosolute growth rate} = \frac{(w_1 - w_0)}{T}$$

Where, W_1 = Prawn weight at the end of study, g; W_0 = Prawn weight at start of study, g and T = Time interval in days

On the basis of collecting average weight data, specific growth rate (SGR) was calculated by using following formula-

$$\text{SGR} = \frac{\text{In log (final weight)} - \text{In log (initial weight)}}{\text{Time (days)}} \times 100$$

Survival rate of the prawn was also calculated by using following formula

$$\text{Survival rate (\%)} = \frac{\text{Nos. recovered}}{\text{Nos. stocked}} \times 100$$

The gross production of *M. rosenbergii* from experimental ponds was estimated at the end of study in terms of kg/ha/crop of 180 days. Data collected from the experiment were subjected to one way analysis of variance (ANOVA) test using the statistical package (STPR 43).

Results and Discussion

Analysis of variance showed that the difference in water quality among experimental ponds was non-significant and within acceptable limits for culture of giant freshwater prawn. The plankton population consisted of Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglinophyceae from phytoplankton whereas Rotifers, Copepods and Cladocerans from zooplankton. The details of minimum, maximum and average weight of prawns at 15 days interval are included in Table 1.The similar result was obtained by Davassi (2011) at the end of 6 months culture where he found final average weight of 28.06g, 32.02g, 35.50g, 25.05g and 22.00g when the initial weight of the prawn was 1.00g, 1.03g, 0.90g, 0.94g and 0.97g respectively on different diets. In the culture period of 180 days, Sarkar *et al*. (1998) recorded final weight of 68 ± 4.9 g, 65 ± 4.0 g and 78 ± 3.9 g respectively in feed, cow dung and cow dung + feed management regimes in earthen ponds,. The details of absolute growth rate of giant freshwater prawn evaluated at every 15 days intervals are presented in Table 2. The value of specific growth rate is used to compare growth on daily basis. The SGR was estimated at 15 days intervals and presented in Table 3. Gupta *et al.,* (2011) observed the specific growth rate of scampi as 1.84 ± 0.46 to 2.24 ± 0.56 on different diet composition. Felix and Jayaseelan (2006) found the highest SGR of post larvae of *M. rosenbergii* on 40% protein feed (6.635 ± 0.095) and lowest on 25% protein feed (5.148 ± 0.072) when they fed the scampi with feeds containing different protein levels (15–45% protein feed). Davassi (2011) estimated SGR ranging from 1.73 to 2.04 on different diets.

In the present study the maximum survival was observed in pond P_1 (Table 4). Average survival was observed as 76.95%. Davassi (2011) found very low survival rate i.e. 13.33-40.00% on different diets. In the study on *Macrobrachium*

Table 1 Details of sampling of freshwater prawn from different experimental ponds (average weight in g ± SD).

Days	Ponds												Pooled
	P_1			P_2			P_3			P_4			
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Avg.
0	-	-	0.04 ± 0.00	-	-	0.04 ± 0.00	-	-	0.04 ± 0.00	-	-	0.04 ± 0.00	0.04 ± 0.00
15	0.22	0.48	0.31 ± 0.08	0.22	0.48	0.33 ± 0.08	0.21	0.48	0.35 ± 0.08	0.21	0.50	0.36 ± 0.09	0.34 ± 0.08
30	0.24	0.87	0.62 ± 0.16	0.42	0.92	0.68 ± 0.13	0.42	0.98	0.75 ± 0.13	0.29	1.17	0.75 ± 0.25	0.70 ± 0.18
45	0.42	1.87	0.97 ± 0.41	0.62	1.63	1.08 ± 0.29	0.33	1.89	1.13 ± 0.46	0.51	2.11	1.15 ± 0.44	1.08 ± 0.41
60	1.28	3.28	2.47 ± 0.52	1.49	4.12	2.54 ± 0.58	1.20	4.19	2.66 ± 0.89	0.53	6.83	2.98 ± 1.59	2.66 ± 1.00
75	2.02	5.39	4.18 ± 0.98	2.08	7.23	4.28 ± 1.41	2.18	7.14	4.32 ± 1.41	2.24	10.99	4.54 ± 1.90	4.33 ± 1.45
90	1.83	22.3	7.68 ± 4.69	3.94	13.13	7.80 ± 2.43	4.09	11.76	7.83 ± 2.15	4.56	11.31	7.89 ± 2.00	7.80 ± 2.98
105	4.82	33.7	10.05 ± 6.39	6.62	23.21	12.88 ± 3.89	8.62	18.53	13.15 ± 3.30	8.20	18.67	13.69 ± 3.00	12.44 ± 4.52
120	9.43	29.94	12.33 ± 4.36	7.98	36.60	15.73 ± 7.27	2.83	32.64	17.16 ± 7.69	6.40	41.12	17.92 ± 9.45	15.79 ± 7.64
135	10.00	43.15	13.58 ± 6.13	11.49	40.40	18.54 ± 7.74	5.02	59.75	19.20 ± 12.51	12.58	39.85	21.79 ± 7.62	18.28 ± 9.22
150	11.02	46.79	14.89 ± 6.57	10.82	51.90	21.76 ± 9.81	11.12	49.93	22.45 ± 10.04	14.35	58.59	25.12 ± 10.28	21.06 ± 9.93
165	11.18	45.32	16.42 ± 6.12	10.76	57.00	22.89 ± 10.14	16.30	48.81	25.81 ± 8.92	16.55	79.66	28.16 ± 14.11	23.32 ± 11.03
180	6.38	72.17	19.54 ± 9.49	0.31	66.48	24.00 ± 11.91	2.06	83.78	28.11 ± 17.08	4.6	98.49	30.48 ± 15.01	25.37 ± 14.21

Table 2 Absolute growth rate (g/day) of *Macrobrachium rosenbergii* in different Experimental ponds.

Days	Ponds				Pooled
	P_1	P_2	P_3	P_4	
15 days	0.0180	0.0193	0.0206	0.0213	0.0200
30 days	0.0206	0.0233	0.0266	0.0266	0.0240
45 days	0.0233	0.0266	0.0253	0.0266	0.0253
60 days	0.1000	0.0973	0.1020	0.1220	0.1053
75 days	0.1140	0.1160	0.1106	0.1040	0.1113
90 days	0.2333	0.2346	0.2340	0.2233	0.2313
105 days	0.1580	0.3386	0.3546	0.3866	0.3093
120 days	0.1520	0.1900	0.2673	0.2820	0.2233
135 days	0.0833	0.1873	0.1360	0.2580	0.1660
150 days	0.0873	0.2146	0.2166	0.2220	0.1853
165 days	0.1020	0.0753	0.2240	0.2026	0.1506
180 days	0.2080	0.0740	0.1533	0.1546	0.1366

Table 3 Specific growth rate (% bw/d) of *Macrobrachium rosenbergii* in different Experimental ponds.

Days	Ponds				Pooled
	P_1	P_2	P_3	P_4	
15 days	5.93	6.11	6.28	6.36	6.20
30 days	2.01	2.09	2.21	2.13	2.09
45 days	1.30	1.34	1.19	1.24	1.26
60 days	2.71	2.48	2.48	2.76	2.61
75 days	1.52	1.51	1.40	1.22	1.41
90 days	1.76	1.74	1.72	1.60	1.70
105 days	0.78	1.45	1.50	1.60	1.35
120 days	0.59	0.58	0.77	0.78	0.69
135 days	0.28	0.48	0.33	0.57	0.42
150 days	0.27	0.46	0.45	0.41	0.41
165 days	0.28	0.15	0.40	0.33	0.30
180 days	0.50	0.14	0.25	0.23	0.24

malcolmsonii juveniles fed with different feeds for 60 days, Soundarapanadian *et al.* (2002) observed survival ranging from 92.1 ± 0.6 to 95.6 ± 0.9%. Gupta *et al.* (2011) found survival of scampi varying from 63.80 ± 7.30 to 77.70 ± 10.20% that is more or less similar to the present experiment. Sarkar *et al.,* (1998) found the survival of 80 ± 2.7 to 84 ± 3.0% under three different management regimes.

With 6156 prawns recovered (76.95% survival) each averaging weight of 25.37g, a gross production of 156.177 Kg was obtained from combined area of 1320 m^2 of four experimental ponds. This equals calculated gross production of 1183.159 kg prawn/ha/ crop of 6 months. Fatema *et al.* (2011) recorded production of giant freshwater prawn ranging from 529.32 to 715.19 Kg/ha/crop of 120 days. Nagarathinam *et al.* (2000) obtained estimated production of *M. rosenbergii* in monoculture grow-out ponds as 984.34 and 1662.26 Kg/ha/crop of 180 days for two different stocking densities.

It is inferred from the results that culture of freshwater prawn, *M. rosenbergii*, is feasible in tarai agroclimatic region of Uttarakhand. Thus, the fish farmers of the area may adopt culture practice of scampi to earn their sustainable livelihood.

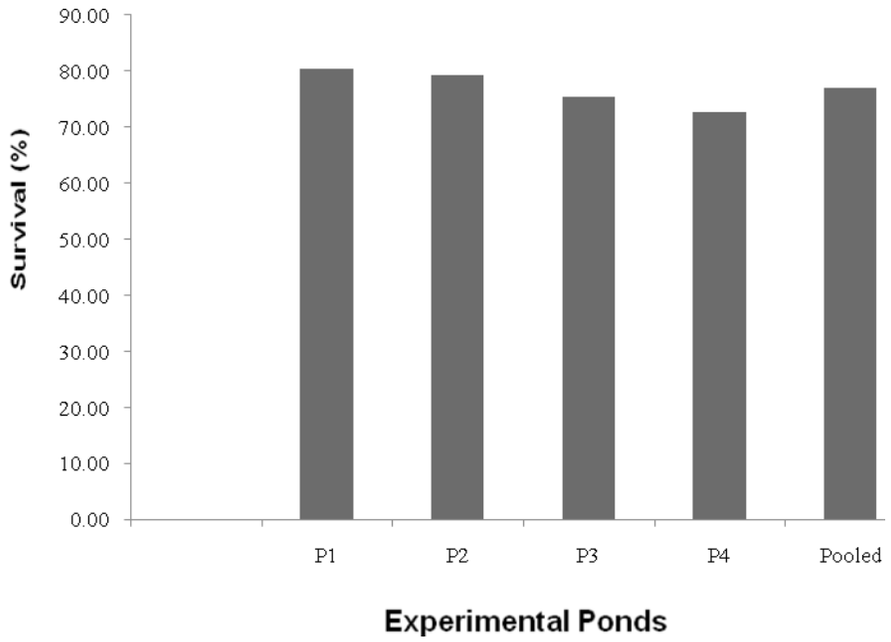

Fig.1 Survival rate of giant freshwater prawn in experimental ponds.

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