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SURVIVAL AND GROWTH IN POSTLARVAE OF *MACROBRACHIUM ROSENBERGII* (DE MAN) ON DIFFERENT DIETS

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Studies on the evaluation of different diets for postlarvae (PL) of *Macrobrachium rosenbergii* indicated higher mortality when fed on pelleted feed than on live *Artemia* nauplii, zooplankton or combination feeds. Statistically significant differences were recorded in the length and weight of postlarvae (at 5% level) fed zooplankton, *Artemia* nauplii and combination feeds when compared to pelleted feed. It suggests the preference of live feed over artifical feed by the postlarvae. Results further indicate that zooplankton promoted growth of postlarvae equal to the growth increment by *Artemia* nauplii either as individual or combination feed.

Key words: Live feed, Zooplankton, Pelleted feed, Postlarvae of *Macrobrachium rosenbergii.*

Introduction

Feeding is one of the most important factors affecting the development, growth and survival of larvae of any cultured species reared under control conditions. In recent years mono- and poly-culture of *Macrobrachium rosenbergii* is fast expanding and many attempts have been made to rear the larvae of this species in hatcheries using artificial and live feed (New 1976; Moller 1978; Ang and Cheah 1980; Fair and Fortner 1981; Kahan 1984; Millamena *et al* 1988; Sheen and D' Abramo 1990; Heinen and Mensi 1991; Alam *et al* 1997). Results of these studies indicate that live feed supports higher survival and growth rate of larvae and postlarvae. Successful larval rearing of *M. rosenbergii* in hatchery operations are mainly dependent on the use of *Artemia* nauplii (Hirano and Furukawa 1979). The ever increasing cost of *Artemia* cyst and their scarcity initiates the search for alternative live feed.

Rotifers and cladocerans were also found to be effective live feed for rearing of *M. rosenbergii* larvae, solely or in combination (Fontaine and Revera 1980; Watanabe *et al* 1983; Alam *et al* 1991, 1993a, b and 1996). Good survival rate and growth of fish and shrimp larvae were reported with zooplankton diet (Kentouri 1981; Medgyesy and Wieser 1982; Yufera *et al* 1984; Millamena *et al* 1990; Armando *et al* 1991; Rina-Chakrabarti and Jana 1992; Rimmer *et al* (1994). Copepods, which constitute major component of the zooplankton, enhanced survival and growth of fish and shrimp larvae (Yamasaki and Canto 1980; Fukusho *et al* 1980; Kraul *et al* 1991). As there was no report on the use of copepods as diet for postlarvae of *M. rosenbergii,* a comparable feeding experiment was conducted with zooplankton (containing copepods predominantly), pelletized feed, live *Artemia* nauplii and combination of these feeds.

Materials and Methods

Postlarvae of *M. rosenbergii* (PL 15) from a single spawn were obtained from Maharaja hatchery, Konerikuppam, Tamil Nadu and transported to the laboratory with least disturbance in two hours time. The postlarvae were maintained in large aquarium tanks (90 cm x 30 cm x 45 cm) with proper aeration and food for a week. For experiment, six batches of 24h starved postlarvae were stocked (@ 100 PL/batch) in plastic tubs (30 cm x 60 cm) containing 150 l of pretreated water. Length and weight of 10 randomly selected postlarvae was recorded from each batch (to the accuracy of 0.1 mm and 0.01 mg) before introducing into the tubs. The experiments were conducted in replicate.

The following six different feeds were tested: (1) Pelletized feed (2 mm dia., crude protein 34%, fat 3.5%, crude fibre 8% and moisture 12%). (2) Freshly hatched *Artemia* nauplii (GSL strain, larval size 450 µ). (3) Zooplankton (collected daily from Chetpet fish pond, Chennai, Tamil Nadu) containing copepods, cladocerans and rotifers in the proprotions of 60%, 25% and 10%, respectively. *Heliodiaptomus viduus, Sinodiaptomus (Rhinediaptomus) indicus* and *Mesocyclops aspericornis* are the major species of copepods. *Ceriodaphnia cornuta, Diaphanosoma sarsi* and *Moina micrura* are the cladocerans while rotifers represented mostly by species of *Brachionus.* Size of the plankton varied from 0.5 mm to 1.8 mm. (4) Pelleted feed + *Artemia* nauplii. (5) Pelleted feed + zooplankton. (6) *Artemia* nauplii + zooplankton.

Prawns were fed ad *libitum* thrice a day at 8, 12 and 16h. They were offered crumbled pellet, live *Artemia* nauplii and zooplankton equivalent to about 30% of the body weight, which was sufficient, as indicated by some unutilized food.

Combination feeds were given in equal ratio in dry weight. The experiments were continued for a period of 30 days. At the end of the feeding trails, total body length and weight of 10 postlarvae were measured at random. The survival rate was estimated by direct counting of the larvae.

During the experimental period, 25% of the water was exchanged every day and completely changed once in a week. The unutilised food and faecal matter of the postlarvae also removed every day from the bottom of the tubs. During the course of experimentation, temperature, dissolved oxygen, pH and salinity remained 30 ± 1°C, 4 ± 1.5 ppm, 8 ± 0.2 and 2 ppt, respectively. The recorded data were analysed for correlation co-efficient and student 't' test (Test of significance).

Results and Discussion

No mortality was recorded in postlarvae fed zooplankton. However, a small percentage of mortality (8%) was recorded in postlarvae fed *Artemia* nauplii and combination feeds. Mortality with pelleted feed varied between 50 and 60%. The initial and final length and weight of postlarvae grown in different feeding regimes are presented in Table 1ab. These results suggest better growth of postlarvae with zooplankton and *Artemia* nauplii than pelleted feed. In the combination feeds, growth appears to be better with zooplankton +*Artemia* nauplii combination than any other combination.

Values of correlation co-efficient 'r' are presented in Table 2 which indicate positive correlations for all the batches. Among the individual feed, higher positive correlation was recorded in zooplankton and *Artemia* nauplii fed animals than those fed on pellets. Pelleted feed + zooplankton fed animals showed highest degree of positive correlation among the combination feed.

The results of test of significance at 5% level Table 3 showed no significant difference either in length or weight of the postlarvae grown on zooplankton or *Artemia* nauplii. In the case of combination feeds no significant differences were recorded for length while values of weight were significantly different. Significant difference was observed in the weight of the postlarvae fed with pelleted feed when compared to any combination feed, while no significant difference was recorded between combination feeds with either zooplankton or *Artemia* nauplii.

Differences were observed in the colour of the postlarvae. Postlarvae fed on *Artemia* nauplii showed distinct red colouration in a week's time which intensified during the course of experiment. Postlarvae fed on zooplankton appeared more whitish than those fed on pelleted feed. Though differences were observed in the colour of postlarvae fed on the combination feed, the intensity of the colour in those feeding regimes was less than the individual feed.

The results of present study suggest preference of live feed over pelleted feed. The high mortality of the postlarvae in the pelleted feed treatment further indicates that higher survival rate of postlarvae can be achieved only when larval feed is supplemented with live feed. Though there are reports indicat-

Table 1a

Initial and final length and weight of the postlarvae of *Macrobrachium rosenbergii* in a 30 day study

	Pelleted feed		Zooplankton		Artemia nauplii	
	Initial	Final	Initial	Final	Initial	Final
Length (mm)						
Mean ±SD	17.2±0.748	22.4±1.052	18.3±0.781	27.3±2.609	18.6±1.2	26.2±1.661
Weight (mg)						
Mean ±SD	19.2±0.748	47.8±4.664	20.1±0.943	63.2±9.389	20.0±0.774	60.7±4.050

Table 1b

	Pelleted feed+ *Artemia* nauplii		Pelleted feed + Zooplankton		Zooplankton + *Artemia* nauplii	
	Initial	Final	Initial	Final	Initial	Final
Length (mm)						
Mean ±SD	18.0±1.549	27.2±1.469	17.9±0.77	26.3.±2.051	17.8±1.98	28.4±2.727
Weight (mg)						
Mean ±SD	19.8±1.284	52..2±4.308	19.5±1.024	56.6±4.484	19.7±1.41	62.2±3.682

ing pelleted feed contributing directly to growth of juvenile *M. rósenbergii* (Balazs and Ross 1976; Fair and Fortner 1981; Ravishankar and Keshavanath 1986 & 1988) this contribution is expressed only when no other food is available. The results of present study suggest that good survival rate of postlarvae can be expected only for a short period (15 days) with pelleted feed. Nevertheless, good growth and survival has been observed when postlarvae are offered pelleted feed in combination with live feed.

The review of Kahan (1984) on live or artificial food for rearing larval stages obviously indicates that the live feed organisms are considered as superior to fresh, frozen or artificial diets, in terms of growth and survival. This might be due to easy ingestion of the live feed organisms and presence of certain essential factors that are absent or deteriorate in non-living feed (Kahan 1984, Neelakantan *et al* 1988). In the present study also postlarvae fed zooplankton and *Artemia* nauplii showed better growth and survival perhaps due to similar reasons. Studies by Chu (1991) on larval rearing of *Metapenaeus ensis* and Penaeus chinensis with artificial and live feed, emphasize that though the larvae could be reared to postlarvae with artificial diet alone, the highest survival and development rates were observed when fed live feed. Larvae fed on only pelleted diet had retarded growth and lower survival than larvae fed on live feed.

Thus live feed plays a vital role in the production of prawn seeds. The growth performance of postlarvae of *M. rosenbergii* can be ranked as follows: zooplankton > *Artemia* nauplii > pelleted feed. However in the combination feed it is ranked as: zooplankton + *Artemia* nauplii > pelleted feed + zooplankton > pelleted feed + *Artemia* nauplii. There is a small difference with regard to the length and weight of *Artemia* nauplii and zooplankton fed animals, these values though are not significant statistically. The difference may probably be due to the colouration of *Artemia* nauplii which facilitates easier predation when compared to zooplankton. The correlation co-efficient computation for 'r' value between length and weight of postlarvae indicates positive relationship, a strong positive correlation is recorded for pelleted feed + zooplankton (r=0.95), zooplankton (r=0.88) and *Artemia* nauplii (r=0.75) than the other types of feed.

Table 2

Correlation co-efficient of length and weight of the postlarvae of *Macrobrachium rosenbergii* in a 30 day study, feeding on different diets

Feed	r
Pellet	0.6511
Zooplankton	0.8790
Artemia nauplii	0.7512
Pellet + *Artemia* nauplii	0.3411
Pellet + Zooplankton	0.9547
Zooplankton + *Artemia* nauplii	0.5993

The postlarvae of *M. rosenbergii* readily accepted the zooplankton food which mostly composed of copepods, cladocerans and rotifers. The acceptance of zooplankton live feed (mostly copepods and rotifers) by the postlarvae of 11 species of marine fishes and crustaceans, have been investigated by Kentouri (1981).

Statistically significant difference were obtained in postlarval length for the following food types. Pelleted feed Vs zooplankton, pelleted feed Vs *Artemia* nauplii, pelleted feed Vs zooplankton + *Artemia* nauplii and pelleted feed Vs Pelleted feed + zooplankton. These results obviously indicate that all types of feed combination promoted good growth in the postlarvae of *M. rosenbergii* except that of pelleted feed as indicated by the test of significance for length and weight.

Thus, the present study clearly suggests that zooplankton either as individual feed or in combination with pelleted feed or *Artemia* nauplii promotes growth similar to use of *Artemia* nauplii alone. This is evident, as statistically no significant difference was recorded in the growth and survival when postlarvae were offered zooplankton in combination with *Artemia* nauplii or pelleted feed. Rotifers and cladocerans were used for larval rearing previously (Alikunhi *et al* 1955; Armando *et al* 1991; Alam *et al* 1993a, b) but the copepod were not tested as principal feed for larval or postlarval rearing of *M. rosenbergii.* The results of present study suggest that a combination of zooplankton may also support good growth in postlarvae of *M. rosenbergii* as the zooplankton offered as food contained 60, 25 and 10%, of copepods, cladocerans and rotifers respectively. Studies of (Altaff 1990; Dharani 1998) show that copepods have short life cycle, high reproductive rate and fecundity. Further, varied size of larvae and adults of this group make it more suitable as food for different larval stages of *M. rosenbergii.*

There are many reports which indicate the suitability of copepods as live feed for larvae and juveniles of fishes, prawns and shrimps (Yufera *et al* 1984; Kuban *et al* 1985; Millamena *et al* 1990; Chen and Chen 1992). Norman *et al* (1979) reported successful use of even the freshwater organisms in frozen condition to marine organisms.

As opined by Neelakantan *et al* (1988), in developing countries like India, where the climatic conditions, availability of

the nutrient and species diversities of live feed organisms favours growth of live feed throughout the year, the utilization of these organism may be helpful for establishment of sustainable aquaculture of *M. rosenbergii.*

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