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RESEARCH ARTICLE

ABUNDANCE AND DIVERSITY OF ZOOPLANKTONS IN FRESHWATER PRAWN *MACROBRACHIUM ROSENBERGII* (DE MAN) CULTURE PONDS

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ABSTRACT

The present study was carried out on the seasonal abundance and diversity of zooplankton in two culture ponds, control and probiotic experiment pond of freshwater prawn *M. rosenbergii*. Plankton samples were collected by plankton net and were narcotised with 20% ethyl alcohol and were preserved in 5% neutral formalin. The zooplankton abundance was influenced by physico-chemical factors. During the study period the occurrence of 30 and 32 species in control and experiment pond respectively were recorded with 4 orders namely Copepoda, Rotifera, Cladocera, Ostracoda. Among al groups copepod was the dominant order. Monthwise total zooplankton population in the probiotic experiment culture pond is 2065 in the momth of may whereas it is 1758 in July month in control pond. In the present experiments, cladocerans were observed maximum numbers in experiment pond than in control pond. The findings of the present study will help to improve the management strategies and roles of probiotics in improving and maintaining water quality in larval rearing water of giant freshwater prawn, *Macrobrachium rosenbergii*..

INTRODUCTION

The freshwater prawn (*Macrobrachium rosenbergii*) commonly known as scampi, has become the main freshwater prawn species for small-scale and large-scale farming because of its fast growth, large size, better meat quality, omnivorous feeding habit, and established domestic and export markets in Asia. Phytoplankton and zooplankton make excellent indicators of environmental conditions and aquatic health within ponds because they are sensitive to changes in water quality. They respond to low dissolved oxygen levels, high nutrient levels, toxic contaminants, poor food quality or abundance, and predation. A good picture of the current conditions in the ponds can be derived by looking at plankton indicators, such as their biomass, abundance, and species diversity (Primavera, 1998).

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The water quality associated with aquaculture developments is an important concern globally, as a variety of negative environmental impacts on the receiving environment have been documented (Lacerda *et al*., 2006). Because it is desirable that ponds and other waters should support phytoplankton and zooplankton species for maintaining good water quality as well as providing a quality food source for the others consumers, it is important to elucidate the trends of species dominance and the probable factors controlling the community structure. The use of probiotics to improve and maintain healthy environment for prawn culture has become popular. Probiotics was used to supply beneficial bacterial strains to rearing water that will help to increase microbial species composition in the environment and to improve water quality (Balcazar *et al.,* 2006). Probiotics is considered to be able to make culture animals healthier by inhibiting the growth of pathogenic bacteria in the same habitat. This has led to new strategy for prevention of disease outbreak and improvement of survival growth. This study aimed to figure out the roles of probiotics in improving and maintaining water quality in larval rearing water of giant freshwater prawn, *Macrobrachium rosenbergii.* Therefore, in the present study, efforts were made to identify the zooplankton which is necessary for the growth and survival of prawn post larvae in culture ponds with respect to both water quality and salinity in prawn aquaculture.

MATERIALS AND METHODS

Materials: Studies were carried out in two nursery ponds, control pond and probiotic experiment pond of 0.603 ha located in Vishnuvakkam, Tiruvallur District, Tamil Nadu, India. The stocking density of PostLarvae 60.000 of *M. rosenbergii* (mean body wt. 1.2 mg) obtained in control pond and probiotic experiment pond was 1.3/m^2. Feeding schedule i.e., starting with starter artificial food for control pond and supplement feed with commercial probiotics for experiment pond was adjusted after every 10 days, and based on the weight gained as per the food schedule.

Methods: Monthly collections of Plankton samples were collected by towing the Plankton net horizontally at a depth of 1.5 feet for about 40 - 50 times during 6.30 - 7.30 am from both the ponds during culture period. The collected samples were narcotised with 20% ethyl alcohol and were preserved in 5% neutral formalin.

Quantitative analysis: For quantification of zooplankton the plankton sample was made up to 10 ml and enumerated using a Sedgewick-rafter counting chamber. The plankton sample was thoroughly mixed and 1 ml of the sample was drawn using a wide mouthed pipette and transferred to the counting chamber. The number of copepods, cladocerans, rotifers, ostracods, eggs, neonates, copepodids and nauplii in ten randomly selected squares of the counting chamber were counted under a compound microscope. The number of plankton per liter was calculated using the formula of Santhanam *et al.* (1989):

$$\mathbf{N} = \frac{n \times v}{V}$$

N= Total number of plankton per liter
n= Average number of plankton in one ml of plankton cell
v= Volume of plankton concentrated (ml)
V= Volume of the total water filtered

RESULTS

The quantity of zooplankton in *M. rosenbergii* cultured ponds were observed.The present study indicated maximum number of zooplankton in probiotic applied pond than control. Qualitative analysis of the zooplankton showed the occurrence of 30 and 32 species in control and experiment pond respectively (Table. 1, 2). Higher mean values of total zooplankton population were recorded in all the monthly samples in probiotic experiment pond except in October month in both the pond (Table. 3). Monthwise zooplankton total population and their percentage contribution of control and experimental pond are presented in Table.4. In the present experiment, the groupwise zooplankton population in control and probiotic experiment pond and their correlation co-efficient values are presented in Table. 5. Higher mean values of zooplankton population contributions presented in probiotic experimental pond during May month only, whereas in control pond in the month of July represented higher numbers. In the present experiments, cladocerans were observed maximum numbers in experiment pond than in control pond (Table. 5).

Table- 1: Qualitative analysis of zooplankton in Control pond of freshwater prawn *M. rosenbergii* culture (February - December 2008)

Rotifers	Cladocerans	Copepods	Ostracods
Asplanchna sp.	*Ceriodaphnia cornuta*	*Cryptocyclops bicolor*	*Cypris sp.*
Brachionus	*Ilyocryptus spinifer*	*Sinodiaptomus*	*(Rhinediaptomus) Indicus*
calyciflorus	*Diaphanosoma excisum*	*Mesocyclops hyalinus*	*Stenocypris sp.*
B. caudatus	*D. sarsi*	*M. aspericornis*	
B. patulus	*Dunhevidia sp*	*M. leukarti*	
B. quadrangularis	*Leydigia sp.*	*Heliodiaptomus viduus*	
B. rubens	*Monia macrocopa*		
B. falcatus	*M. micrura*		
B. urcelaris	*Pleuroxus aduncus*		
Filinia sp.	*Simocephalus vetuloides*		
Keratella quadrata	*Macrothrix sp.*		

Table 2. Qualitative analysis of zooplankton in probiotic Experiment pond of freshwater prawn *M. rosenbergii* culture (February - December 2008)

Rotifers	Cladocerans	Copepods	Ostracods
Asplanchna sp.	*Ceriodaphnia cornuta*	*Cryptocyclops bicolor*	*Cypris sp.*
Brachionus	*Ilyocryptus spinifer*	*Sinodiaptomus*	
calyciflorus	*Diaphanosoma excisum*	*(Rhinediaptomus) Indicus*	*Stenocypris sp.*
B. caudatus	*D. sarsi*	*Mesocyclops hyalinus*	
B. patulus	*Dunhevidia sp*	*M. aspericornis*	
B. quadrangularis	*Leydigia sp.*	*M. leukarti*	
B. rubens	*Monia macrocopa*	*Thermocyclops sp.*	
B. falcatus	*M. micrura*	*Heliodiaptomus viduus*	
B. urcelaris	*Pleuroxus aduncus*		
B. forficula	*Simocephalus vetuloides*		
Filinia sp.	*Daphnia carinata*		
Keratella quadrata	*Macrothrix sp*		

Table. 3. Mean and SE values of total zooplankton population in control and probiotic experiment pond (February - December 2008)

Month	Ponds	Mean ± SE
February	Control	119.142 ± 14.988
	Experiment	142.285 ± 15.688
March	Control	195.571 ± 25.296
	Experiment	238.428 ± 22.680
April	Control	165.000 ± 36.255
	Experiment	144.142 ± 37.161
May	Control	248.666 ± 23.807
	Experiment	295.000 ± 74.442
June	Control	204.142 ± 32.142
	Experiment	267.33 ± 40.943
July	Control	251.429 ± 44.842
	Experiment	280.428 ± 51.591
August	Control	136.428 ± 26.138
	Experiment	153.428 ± 24.380
September	Control	140.285 ± 35.109
	Experiment	159.571 ± 33.701
October	Control	105.857 ± 19.87
	Experiment	131.428 ± 19.870
November	Control	141.428 ± 27.187
	Experiment	165.142 ± 21.147
December	Control	106.714 ± 18.824
	Experiment	152.857± 25.248

Table- 4. Monthwise total zooplankton population and percentage in the control and probiotic experiment freshwater prawn *M. rosenbergii* culture pond

Months	Control		Probiotic Experiment	
	Total	percentage	Total	percentage
February	834	6.787	996	6.801
March	1369	11.141	1669	11.397
April	990	8.057	1009	6.870
May	1492	12.142	2065	14.102
June	1429	11.630	1604	10.734
July	1758	14.307	1963	13.405
August	955	7.772	1074	7.334
September	982	7.992	1117	7.607
October	741	6.030	920	6.282
November	990	8.057	1156	7.894
December	747	6.079	1070	7.307
	12287		14643	

Table-5. Groupwise zooplankton in control and Probiotic experiment ponds (t-test analysis)

Groups	Ponds	Mean ± SE	T-test value	Significance
Copepods	Control	154.545 ± 14.175	10.902	0.000
	Experiment	186.909±17.096	10.932	0.000
Cladocerans	Control	254.818 ±26.9	9.473	0.000
	Experiment	326.454 ± 43.489	7.506	0.000
Rotifers	Control	196.818±28.225	6.973	0.000
	Experiment	173.909± 32.734	7.137	0.000
Ostracods	Control	149.909±18.634	8.045	0.000
	Experiment	233.636±16.713	10.405	0.000

Mean of 11 sample Significant at the 5% level ($P<0.05$)

Higher number of zooplankton were noticed during culture period are presented in Table 5. In the present study, higher percentage of zooplankton were noticed in the month of July in control and in May month in probiotic experimental pond respectively. In t-test analysis, monthwise total zooplankton showed significant ($P<0.05$) results (Table.5).

DISCUSSION

The present study indicates the occurrence of copepods, cladocerans, rotifers and ostracods showed of 30 and 32 species in control and experiment pond respectively (Table. 1, 2). Zooplankton assemblages comprise a significant component of the natural biota of shrimp aquaculture ponds and present rapid temporal changes in structure (Preston *et al*., 2003). The present study was in accordance with the work of Kunda *et al*., 2008 who reported that rotifera (7 genera), cladocera 5 genera, copepod 3 genera and crustacean nauplii in prawn – mola different stocking density.

Similarly, Wahab *et al*. (2008) also reported, 16 genera of zooplankton belonged to copepods (3 genera), cladocera (5 genera), rotifera (7 genera) and crustacean and nauplii in prawn-small fish culture practice in Bangladesh. Zooplankton showed variations with regard to their abundance during the different months of culture periods both in control and experiment pond. The initial zooplankton contents were low (115 and 152 numbers in control and experiment ponds, respectively) which increased tremendously in the month of March in both ponds, such a increased zooplankton density might have resulted from the microbial mixture and application of lime in both the ponds, whereas in higher numbers of zooplankton in the experimental pond indicates application of probiotic through feed, vitamin and mineral mix (mutagen) metal and minerals (Sodamix) and also due to the availability of phytoplankton on which zooplankton forage. Further, depletion in phytoplankton might also have caused lesser density of zooplankton. Wang *et al* (2005) noticed the high density of zooplankton by the effectiveness of commercial probiotics in northern white shrimp *Penaeus vannamei* ponds. Preston *et al*. (2003) who reported variations in zooplankton abundance and composition of species. The present study was similar to the study of Case *et al*. (2008) who reported the noticed value of high density of zooplankton in probiotic experimental pond in the present study might be due to application of probiotics to the pond when compared to control. In the present observations, higher density of zooplankton was recorded in probiotic experimental pond than in control pond. The abundance of zooplankton was also similar to that found by Azim *et al.* (2004) in a periphyton based carp culture in Bangladesh, suggesting that the zooplankton community were preferred by adult fish.

However, in the present study the introduced fingerlings preferred the zooplankton as their food. Higher density of zooplankton in the present work can be attributed to the availability of suiTable phytoplankton. The present report showed that zooplankton density of control and probiotic experiment pond was positively correlated with groupwise total and monthwise total zooplanktons. Total copepod population, rotifer, cladocerans and ostracod population of control and probiotic experimental pond was positively correlated and statistically significant at 0.01 level. Transparency reading were negatively correlated with zooplankton abundance, therefore zooplankton were higher when the algal biomass was higher (Coman *et al*., 2006). Many earlier investigations also recorded higher survival and weight gain in post larvae of *M. rosenbergii* when fed on zooplankton from a wild source than an artificial diet (Brown *et al.,* 1992; Collins, 1999).

Conclusion

Abundance of high density of zooplankton in probiotic experimental pond which clearly indicated that probiotic applications enhance the microbial population without harm to cultivable freshwater prawn *M. rosenbergii*. Among the feeds used, Probiotic feed were more condusive for prawn culture, as these plays a vital role. The present study was undertaken in outdoor earthen pond trails and the finding is confirmed that the probiotics are beneficial to improve water quality, enhance the growth of Zooplankton. In future, the application for probiotics looks bright

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