Commercial probiotics as controlling agents of bacterial micro flora in semi-intensive shrimp culture ponds

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SUMMARY

This study examines the possible use of probiotics as controlling agents of pathogenic *Vibrio* (yellow and green colonies) in the culture ponds of *Penaeus monodon*. The total heterotrophic bacteria (THB) and *Vibrio* (yellow and green colonies) were monitored through 30, 60, 90 and 120 days of culture in three successive summer crops (C_1, C_2 and C_3) in control (CP) and probiotic treated (WFB, FPB and WFPB) ponds. THB count increased significantly ($P<0.05$) in control as well as probiotic treated pond water with increase of culture duration. *Vibrio* (yellow and green colonies) count was significantly ($P<0.01$) higher in control (CP) than in probiotic treated ponds. FPB and WFPB treated pond waters showed no *vibrio* colonies at 90 days of culture in C_2. The application of probiotics obviously reduced *Vibrio* population through competitive exclusion was discussed.

Key words : *P. monodon*, Probiotics, THB, *Vibrio*, Semi-intensive culture

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Consecutive outbreaks of viral and bacterial diseases have devastated shrimp culture in many Asian countries during the last few years resulting in huge economic losses (Moriarty, 1998; Sung *et al.*, 2001). In India alone losses due to shrimp disease outbreaks were put at US $ 400 million between 1993 and 1995 (MPEDA, 2000). *Vibrio* species represent a large proportion of bacterial population of marine environment and act as pathogenic primary and secondary invaders of shrimp in culture systems (Lightner, 1996; Sung *et al.*, 2001). As a result farmers started using antimicrobial compounds and antibiotics as prophylactics in large quantities even when pathogens are not evident. This has led to an increase in *Vibrio* and presumably other bacteria, having multiple antibiotic resistance and to an increase in more virulent pathogens (Moriarty, 1998).

Bioremediation with probiotics is a potent biotechnological approach in the degradation of hazardous organic wastes to substances that are environmentally safe by induction of microorganisms like *Pseudomonas*, *Bacillus*, *Nitrosomonas*, and *Nitrobacter* spp. which have the ability to degrade organic substances (Mohan Kumar *et al.*, 2005) in aquatic environment.

Microorganisms present in the bottom of the pond are known to play an important role in nutrient cycling and decomposition (Anderson, 1987; Coleman and Edwards, 1987; Rheinheimer, 1992) by degradation of organic matter in pond waters (Avnimelech *et al.*, 1995) and thereby improving the water quality. Organic matter is degraded by a wide variety of microorganisms. For instance, heterotrophic microorganisms oxidize organic matter consuming oxygen and releasing carbon dioxide while autotrophic nitrifying and sulphur bacteria consume oxygen and carbon dioxide in the process of oxidizing ammonia, nitrite and sulphide.

Although studies have been carried out on the role of heterotrophic bacterial populations in shrimp culture (Ruanpam *et al.*, 1995; Anand *et al.*, 1996) much attention has not been paid to understand the role of probiotics (beneficial bacteria) in nutrient recycling. Thus an attempt was made in the present study to understand the role of probiotic bacteria in controlling and minimizing the pathogenic bacterial load in the pond environment.

MATERIALS AND METHODS

The present work was carried out in a private shrimp farm (Sharat Sea Foods Industries Ltd.) near Venkannapalem village (14°.2'E; 80°.5'N) of Nellore District, Andhra Pradesh, India during three summer crops (March to July, 2004; Feb. to June, 2005; March to June, 2006). Semi-intensive shrimp culture ponds (~ 1ha) adopted for this work during each summer were divided into four groups of three each. The first group of ponds treated with no