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SUMMARY OF THE FINAL REPORT

of work done on

UGC- MAJOR RESEARCH PROJECT

DEVELOPMENT OF PROBIOTICS FOR FISH AND SHELLFISH

(F. No. 41-87/2012-SR)

Aquaculture has emerged as one of the most promising and fastest-growing industries, and provides high-quality animal protein, raises nutritional levels, and generates income and employment around the globe. Indian Aquaculture production mainly consists of carps and crustaceans such as freshwater prawn. With the ever increasing demand for fish protein, there has been a shift in aquaculture practices, moving from extensive systems towards the semi-intensive and intensive systems. Bacterial infections are one of the important causes of disease problems in Indian aquaculture. The widespread use of broad-spectrum chemotherapeutics to combat such health related problems has led to the development and spread of drug resistant pathogens, environmental hazards and food security problems. Use of probiotics has been gaining importance for disease prevention in aquaculture as an eco-friendly alternative to antibiotics and other drugs. Probiotics exert beneficial effects on the host by providing nutrients and enzymatic contribution to digestion, improving water quality, enhancing growth, inhibiting pathogenic microorganisms and enhancing immune response. The most commonly used probiotics in fish farming belong to gram positive spore forming *Bacillus* spp. *Bacillus* preparations are resistant to the environment, have a long lasting shelf life and the beneficial roles of these bacterial species in the aquaculture field are well established.

In the present UGC major research project on 'Development of Probiotics for Fish and Shellfish', we screened and evaluated the efficiency of different strains *viz.* *Bacillus coagulans*, *B. licheniformis* and *Paenibacillus polymyxa* as potential probiotics for fish and shellfish. Probiotic characteristics of selected strains were evaluated by i) assessment of *in-vitro* antimicrobial assay/antagonistic activity against pathogens; ii) evaluation of harmful effect of strains by i.p and i.m. injection in fish; and iii) study of intestinal colonization of strains through competitive exclusion study. The whole research work initiated and completed is divided into four chapters. In the first chapter, we studied the effect of dietary supplementation of probiotics on carps *viz.* *Cyprinus carpio* and *Catla catla*. The results indicated that the supplementation of *P. polymyxa* (@10⁹ cfu/g) significantly enhanced not only the growth performance and feed utilization but also digestive enzyme activities, non-specific immune

responses and disease resistance of fish. In the second chapter, we evaluated the effect of different levels of *Bacillus coagulans* and commercially available probiotics (Sporlac, Improval and Protexin) on giant freshwater prawn, *Macrobrachium rosenbergii*. The results of study demonstrated that the use of *B. coagulans* (@ 1.5×10^9 cfu/g) as a dietary probiotic could significantly improve survival rate, growth performance, feed utilisation and digestive enzyme activity besides enhancing immune response of freshwater prawn *M. rosenbergii*. However, among different commercially available probiotics, incorporation of Sporlac (containing *Bacillus coagulans*) in the diet resulted in better performance. The third chapter comprised of experiments undertaken to evaluate the effect of *P. polymyxa* as water additive on common carp, *C. carpio* based on water quality, survival, growth performance, digestive enzyme activities, innate immune responses and disease resistance against *Aeromonas hydrophilla*. The results obtained showed that addition of *P. polymyxa* as water additive at moderate concentrations (10^4 cfu/ml) was effective in maintaining optimum water quality and fish digestive enzyme activities, thereby conferring higher growth performance and feed utilization of *C. carpio*. *P. polymyxa* also induces upregulation of innate immunity and disease resistance. In the chapter four, synbiotic effect of probiotic *P. polymyxa* and a short-chain fructooligosaccharide (FOS) prebiotic (Inulin) on growth performance, digestive enzyme activity, immune responses and disease resistance against *Aeromonas hydrophila* was evaluated in *Labeo rohita*. The results of the study indicated that use of Inulin (@ 0.2%) and *P. polymyxa* (@ 10^6 cfu/ml) as synbionts resulted in improved growth performance and enhanced immune responses of fish. It also reduces the prevalence of *A. hydrophilla* related disease problems. The present research work support the development of adequate technology for the screening and evaluation of the microbial agents as probiotics in aquaculture. The screened strains, at different concentrations in feed and water, worked effectively in maintaining water quality, survival, growth and induce upregulation of digestive enzyme activity and innate immunity of carps and freshwater prawn. The data obtained will serve as health indicator in stress, nutrition or infection-related studies. The negative environmental effects on aquaculture could be mitigated through the use of screened probiotics. It will also help in development of new eco-friendly control strategies and intervention programs for future aquaculture practices.

PUBLICATIONS

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