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Isolation, experimental transmission and eco-friendly management of vibriosis in penaeid shrimp (penaeus monodon) using microalgae culture

Muralidharan Velappan, Deecaraman Munusamy
Department of Marine Microbiology, Amet University, India
Department of Biotechnology, Dr. M.G.R Educational & Research Institute, India

Abstract:

Globally, the most common penaeid shrimps currently being cultured are Penaeus monodon. As per the FAO statistics, the world production of cultivated shrimp has increased since the early 1980's. Over a period, the demand for shrimp is exponentially increased. It is estimated that more than 50% of the world production of penaeid shrimp is contributed by P. monodon. In India intensification of shrimp culture methods and improper management strategies caused the shrimps to face stress and injury as well as consequent diseases, which devastated the farming activities. Infectious diseases constitute a main barrier to the development and continuation of shrimp aquaculture in terms of quality, quantity and regularity and also continuity. According to Global Aquaculture Alliance (GAA) survey, in 2001 an overall loss to aquatic animal disease of approximately 22% in a single year, and with respect to disease agents, the majority of efforts on disease control 80% focused on viral and bacterial pathogens. Several studies have indicated that resistance may be increasing in developing countries and diarrheal disease is one of the most important cases of illness and death occurs in young children. Moreover, the control of infectious diseases in aquaculture is seriously threatened by the steady increase in the number of pathogenic microorganisms that are resistant to antimicrobial agents.

Vibrio infection has been implicated as a major mortality factor in juvenile penaeid shrimp. *Vibriosis* caused by *V. alginolyticus and V. harveyi* is still serious disease problem in cultured black tiger shrimp in India. Despite, penaeid acute viremia (white spot syndrome virus WSSV) prevails in Asian countries; *Vibrio* is considered as members of the normal bacterial flora of shrimp and the culture environment. Often acting as an opportunistic pathogen or secondary invaders, they induce mortality ranging from slight to 100% in affected population under stress. Vibrio sp isolated from diseased penaeids include *V. alginolyticus, V. harveyi, V.parahaemolyticus, V.vulnificus, V. damsela and V.anguillarum*.

It is well known that species associated with vibriosis family have long-term pathologic side effects involving humans causing gastroenteritis, septicemia and wound infections and aquatic animals with economic and environmental impact. Therefore, there is a necessity of search for novel environmental friendly solutions and also cost effective treatment technologies are urgently needed for controlling vibriosis in aquatic animals. The total sterility of rearing water in the entire culture period by pretreatment is practically impossible. Thus the pathogenic Vibrios inadvertently enter into the rearing water and may cause outbreaks. Initial management of such outbreaks by reducing the stocking density or carrying capacities are considered as uneconomical due to increased production costs. The pre- infection therapy such as vaccine is still under investigation for the field use. Moreover, post-infection therapy using medicated feeds incorporated with antibiotics are possible to a certain extent, the impact of antibiotics in the environment and consumer health is highly risky. Chemotherapeutic agents such as chlorine or formalin are also unlikely to have much impact on the pathogens, since the concentration required killing such established vibrio pathogens are detrimental to the survival of the candidate larvae/post larvae as well as juveniles. Research is being focused on alternate effective methods of disease management using vaccines and immunostimulants of microbial origin. However successful use of such products are only described for fish and not for shrimp. Vaccine development for the shrimp is impractical due to the lack of specific immune system. Nevertheless, there is an evident attraction about using derived-algae species such as microalgae for the prevention of the vibriosis diseases and enhancing of vibrio resistant in marine species, specifically shrimps. Furthermore, we presented the T3SS1 effectors' mechanism, three conventional treatments, the microalgae-based treatment, and a proposed novel, environmental friendly microalgae-based solution for the inhibition of vibrio strains inside marine organism useful for the aquaculture industry.

Considering then, the present study was initiated to develop cost effective therapeutants from microalgae species i.e. Chlamydomonas reinhardtii, Chlorella vulgaris, Klebsormidium flaccidum, Cosmarium impressulum, Kirchneriella lunaris, and Spirulina platensis can be potential inhibitors of the bioactivity in Vibrio outbreak in penaeid shrimp. The work was carried out mainly isolation of secondary/ pathogenic Vibrio sp. from the outbreak caused by devastating WSSV in penaeid shrimp. Finally, experimental transmission and evaluation of pathogenicity of the Vibrio isolates.