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Marine Biotechnology, an Indian Perspective

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The global market for products from marine biotechnology is forecast to reach over $4 billion by 2015 and therefore marine bio-resources offer a lot of scope for the health and well being of aquaculture production in the country through marine bio-business. The Department of Biotechnology (DBT) has been supporting the program area of Aquaculture & Marine Biotechnology, covering both R&D and applied aspects through competitive grant scheme with the operational inputs from the Task Force Committee and with impetus during Brain Storming Sessions and workshops. For the past two decades, the department has been concentrating on developing technology for seed production and grow-out pond culture for economically important finfish and shellfish species, and also on seaweeds.

It has been demonstrated that the technology developed by the department can produce fresh water prawn up to 1.5 to 2.0 ton/ha. Farmers who adopted this technology have been benefited. It is also noteworthy to mention that DBT has demonstrated high production rate in shrimp culture through semi intensive shrimp culture technology by producing 10 t/ha per annum in two crops.

Research on induced breeding and maturation in commercially important fish and shrimp species has been carried out. Research has also been focused on various aspects such as Diagnostics, Vaccines, Recombinant products, Anti-microbial Peptides, Immunostimulants, High-energy and high-protein Aquaculture Feed, Fish Spawning Agents, Human Therapeutics (Omega-3 and 6), Water Quality Management, value addition and product & process development. Inventorisation and digitalization of marine and coastal bio-resources pertaining to marine mollusk are being carried out. Proposals through Public-Private Partnerships were pursued for leads in water re-circulatory system and management of metabolite load in the culture operations.

During the last plan (2007-12), the Department has given major attention to aquatic health management. The emphasis was on development of technology for screening healthy population of shrimp/fish brooders based on molecular markers. In India, the loss of shrimp due to WSSV has been estimated to be about $150 million per year (CIBA, 2008). Application of various technologies especially biotechnological tools has made an impact in reducing disease risk. In addition, recent technologies are contributing to the future enhancement of aquaculture production. Vaccine is very important to prevent diseases in aquaculture systems. The DBT has funded many R&D projects to develop vaccines against different viral and bacterial pathogens of fish and shrimp.

Recombinant and DNA vaccines have been developed for Aeromonas hydrophila, Vibrio anguillarum, Edwardsiella tarda, fish nodavirus, WSSV and MrNV. Recombinant vaccines using different genes such as OmpTS, Aha1 and OmpW have been developed and their efficacy against A. hydrophila was tested and found to be effective. Inactivated whole WSSV vaccine, recombinant subunit vaccine and DNA vaccine using different viral genes have been proved to be useful in small scale against WSSV in shrimp. Different types of Immunostimulants of bacterial or plant origin have been developed for cultivable organisms for their protection from viral and bacterial pathogens. Recently, a project on application of RNAi to control WSSV in shrimp has been funded by the DBT and good leads have been obtained.

The Department has been laying major emphasis on the creation of centers of Excellence in the area of Marine Biotechnology addressing important areas like RNAi technology, nano-technology, extremophiles, cell-line development and their application, user friendly diagnostics and vaccines for new emerging diseases, immuostimulants, brood-stock development, production of disease free seeds, low cost feed development, and post harvest technology, natural product development, bio-fuels from marine algae, novel microbial enzymes for industrial applications, novel drugs from marine organisms for medicinal value etc. The University of Science and Technology at Cochin, Kerala, is working on projects in Marine Biotechnology covering aspects like genotypic characterization, gene-sequencing and isolation of novel enzymes and marine natural products and biomaterials, as well as establishing a database on marine biotechnology with the infrastructure and manpower support provided by the Department of Biotechnology.