APPLICATION OF BIOTECHNOLOGY IN AQUACULTURE

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World fish production comprises both catches of wild fish and production through aquaculture. In recent years, fish production has steadily increased to approximately 120 million tons. Behind this success, aquaculture biotechnology has a prominent role. It is the process in which biological systems or living organisms and technological aspects are combined. It is a branch, where the production process is enriched through the proper utilization of biological systems or living organisms. Proper utilization of biotechnology has a wide range of useful applications in the fisheries and aquaculture sector. The biotechnological tools have the greate potentiality to increase aquacultural and agricultural production to improve the health and livestock, prevent pollution, provide protection to the environment. In this article, we will discuss briefly the application of biotechnology in aquaculture.

Application in aquaculture

Provide an alternative protein source for fish

Fish meal is the most common protein source for fish. It is high-quality by-product of fish processing with high protein content. But the use of fish meal as a protein source for fish has several drawbacks. First of all, fish meal is very much expensive, so there is a need for a cheap alternative for fish meal. Secondly, because of the declining phase of wild fish stock, the supply of fish meal sometimes become irregular, as we know that fish meal is a by-product of wild fish. Last of all, the use of fishmeal for aquaculture purposes, is not environmentally friendly, because it can cause several environmental problems. The main reason for that, it contains a high level of phosphorus. When this excess phosphorus mixed up with water, causes excess algal growth, otherwise known as eutrophication. So, the

replacement of fish meal with any alternative plant-based protein source can be the best option to solve this problem. Through the use of plant-based protein source, we can minimize the problem of phosphorus accumulation. But plant-proteins contain anti-nutritional compounds which must be destroyed during processing or otherwise alter the feed utilization ability of the fish. Biotechnological tools are used to treat those anti-nutritional factors during the processing of these plant proteins. Researchers are trying to encounter these anti-nutritional factors through the production of some feed enzymes. Phytase is one example.

Bio-remediation

Unlike, terrestrial animals, aquatic animals are more sensitive to their surrounding environmental changes. The immediate environment of the aquatic animals, i.e., water, act as a carrier of their waste products and pollutants from nearby environment. The disease-causing mechanisms of aquatic organisms are more strongly connected to environmental conditions than terrestrial animals, like cattle. So, biotechnological tools are developed in aquaculture, is bio-remediation to solve this circumstance. Bio-remediation is a breakdown process through which environmental pollutants are consumed by micro-organisms to produce a cleaner environment. In the aqua cultural field, this indicates the use of "friendly bacteria" for the treatment of water/feeds by natural processes and discourages the development of "unfriendly bacteria" that have the capacity to cause disease.

Development of transgenic fish

Transgenic fish is one species that contain genes from other species. Main purposes of the development of transgenic fishes are to enhance fish quality, growth, resistance and productivity. So, we can say that transgenic fish is an improved variety of fish consists of one or more foreign gene which are desirable to solve these purposes for that species. These fishes are genetically modified fish. Various types of biotechnological tools are incorporated into those transgenic techniques.

Genetic biotechnology on fish health

Genetic biotechnology have a greate role on improvement of fish health and their treatment. These biotechnological tools help scientists to select disease-resistant strains. DNA-based technologies are being used for these purposes. Molecular investigations on genetic characterization of pathogens provide information about their origin. They meet the purpose of detection of viral diseases of marine shrimp as well as bacterial and fungal

pathogens in fishes. Rapid, reliable and highly sensitive diagnostic tests are required for effective control and treatment of aquatic animal diseases. Because of cost-involvements, time-taking nature and unavailability of suitable cell-line for shrimps /crustaceans for the virus, a direct method of pathogen culture is not available. Most of the time, immunoassay methods, DNA-based diagnostic methods and PCR techniques are used to overcome these problems.

Vaccines

Biotechnological tools have great contributions to the development of vaccines and immune stimulants for aqua cultural species. Vaccines and immune stimulants have a great role either in immunity enhancement or disease prevention. Many commercially available vaccines are there, e.g. furunculosis. Many more are under processing e.g., viral hemorrhagic septicemia(VHS).Apart from their role in the reducing of the severity of the diseases they also serve many other purposes, like reduce the importance of antibiotics and do not induce antibiotic resistance. These vaccines and immune stimulants are incorporated in fish via feeding additives, immersion or in case of larger animals, via injection. Recently, genetically engineered vaccines are being applied for the purpose of protection against pathogens.

Challenges

- Transgenic techniques offer the way of producing large scale changes in growth rate in comparison to other approaches. The exploitation of transgenic techniques most of the times causes environmental damages, which can result in the development of some reversible sterile fishes. These fishes could be made fertile by simple treatment like hormonal injections.
- Another important concern is that the unpredictable consequences of these transgenic fishes because of unknown genetic modifications, make their uses undesirable.
- Careful planning, field trials and cost-evaluations are also necessary before the development of vaccines and their applications which demand considerable research upon target pathogens, as well as resultant diseases.
- Above all, the use of vaccines is very much difficult or some times, too costly for developing countries, which creates major obstructions in the path of adoption of biotechnology in aquaculture.
- Intellectual property and accessibility are the two most important limiting factors, that limit the application of biotechnology in aquaculture.

Conclusion

The applications of biotechnology in aquaculture have significant contributions. It is considered as one of the most promising areas to enhance fish production. The increased application of biotechnology in aquaculture not only revolutionizes the aqua cultural sector but also increases the foreign earnings of the country in a strategic way. But due to several negative environmental impacts, the excessive use of biotechnology in aquaculture is not recommended. So, it should not be used as the substitutes of traditional technologies. We can conclude that the application of biotechnology in aquaculture should be need-driven instead of technology-driven.

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