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Biotechnology: To speedup aquaculture

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Abstract
Fish farming is the world's fastest-growing sector of agricultural business. Consumer demand for fish products is increasing. At the same time, wild fish stocks are rapidly declining, mainly because of over-fishing. Increased public demands for fish and dwindling natural marine habitats have encouraged scientists to study ways that biotechnology can increase the production of fish and shellfish. The science of biotechnology has endowed us with new tools and tremendous power to create novel genes and genotypes of plants, animals and fish. The application of biotechnology in the fisheries sector is a relatively recent practice. Nevertheless, it is a promising area to enhance fish production. The increased application of biotechnological tools can certainly revolutionise our fish farming besides its role in biodiversity conservation.

Keywords: Aquaculture, biotechnology, fish nutrition, health management

Introduction

At present, aquaculture is playing the game-changing role in world fish production. There is international recognition that many of natural ocean and freshwater fisheries are being harvested to their limit. Aquaculture could help to meet increasing demand, and biotechnology can make a great contribution to improving aquaculture yields. Aquaculture animals are particularly well suited for research in biotechnology. Remarkable achievements have been made in the recent past in increasing production of crops, livestock and poultry through genetic and bio-technological tools. The potential areas of biotechnology in aquaculture include the use of synthetic hormones in induced breeding, production of monosex, uniparental and polyploidy population, molecular biology, transgenic fish, gene banking, improved feeds and health management and development of natural products from marine organisms [1].

Gonadotropin Releasing Hormone (GnRH) is now the best available biotechnological tool for the induced breeding of fish. The most recent GnRH purified and characterized was by [2] and [3]. Depending on the structural variant and their biological activities, a number of chemical analogues have been prepared and one of them is salmon GnRH analogue profusely used now in fish breeding and marked commercially under the name of "Ovaprim" throughout the world. In fact, most of the economically important culturable fish in land locked water do not breed until the hormone induces them. The induced breeding of fish is now successfully achieved by the development of GnRH technology.

Chromosome sex manipulation techniques to induce polyploidy (triploidy and tetraploidy) and uniparental chromosome inheritance (gynogenesis and androgenesis) have been applied extensively in cultured fish species [4, 5]. These techniques are important in the improvement of fish breeding as they provide a rapid approach for gonadal sterilization, sex control, improvement of hybrid viability and clonation.

Transgenesis or transgenics may be defined as the introduction of exogenous gene/DNA into host genome resulting in its stable maintenance, transmission and expression. The technology offers an excellent opportunity for modifying or improving the genetic traits of commercially important fishes, mollusks and crustaceans for aquaculture. The idea of producing transgenic animals became popular when Palmitter *et al.* [6] first produced transgenic mouse by introducing metallothione- in human growth hormone fusion gene (mT-hGH) into mouse egg, resulting in dramatic increase in growth.

The cost of feed ingredients and other inputs are increasing, while market costs for the major cultivable finfish and shellfish species have remained static or are decreasing. It is, therefore, likely that increased aquaculture production will be from herbivorous/omnivorous fishes in developing countries of Asia and other parts of the world. Aquaculturist can reduce the current dependence on the natural marine resource to farm carnivorous finfish and shellfish through the use of the low cost, locally available, alternative feed ingredients [7]. The use of biotechnologically improved products and appropriate use of locally available feed ingredients in semi-intensive aquaculture is still needed. Advancement of fish nutrition relies on developing feeding strategies based on renewable feed ingredients and employing biotechnological techniques especially the use of microbes and/or heat-stable microbial enzymes [8].

The process of disease in aquaculture species is thus much more strongly connected to environmental factors that would be the case say, with cattle. A further biotechnology field that has developed in aquaculture, because of the nature of this relationship, is that of bio-remediation. This refers to the use of friendly bacteria or 'probiotics' to treat water or feeds and by natural processes, discourages the development of 'unfriendly' bacteria that potentially would cause disease [9].

Researchers are seeking to improve the genetic traits of the fish used in aquaculture by using different transgenic techniques. Researchers are trying to develop fish which are larger and grow faster, more efficient in converting their feed into muscle, resistant to disease, tolerant of low oxygen levels in the water and tolerant to freezing temperatures. However, limited growth rate and excessive reproduction resulting in fish that are small and variable in size, still pose a considerable constraint to the exploitation of Tilapia in developing countries. Transgenic techniques offer the means of producing immediate large quantum changes in performance, for example in growth rate, that far exceed those attainable with other approaches [10, 11].

Genetic biotechnologies are being used to improve fish health through conventional selection for disease resistance and through the use of molecular investigation of pathogens for characterization and diagnosis. DNA-based technologies are being used now to characterize different species and strains of pathogens. Genetic characterization of the pathogen may also reveal information about its origin e.g. DNA analysis revealed two strains of crayfish plague fungus in Sweden, one from the local species and one originating in Turkey [12].

The vaccines and immunostimulants can be administered via additives in feeds, immersion or in the case of the larger culture animals like fish, by injection. Genetically engineered vaccines are also being developed to protect fish against pathogens. Genetically applied immunization of rainbow trout with a glycoprotein gene from the virus causing viral hemorrhagic septicemia has recently been shown to induce high levels of protection against the virus.

The technology of cryopreservation of fish spermatozoa (milt) has been adopted from animal husbandry. The first success in preserving fish sperm at low temperature was reported by Blaxter (1953) who fertilized herring (*Clupea harengus*) eggs with frozen-thawed semen. The spermatozoa of almost all cultivable fish species have now been cryopreserved [13]. Cryopreservation overcomes the problem of males maturing before females, allows selective breeding and stock improvement and enables the conservation of genomes [14].

The application of biotechnology in aquaculture is making significant contributions. However, it should be used as adjuncts to and not as substitutes for conventional technologies in solving problems. Its application should be need-driven rather than technology driven; though it is a promising area to enhance fish production. The increased application of biotechnological tools can certainly revolutionize aquaculture. Such a strategy would not only reduce the importation of foreign fish and aquaculture products into the country, but the foreign earnings can also be used to build the nations degrading infrastructure and provide all citizens with basic amenities.

References

1. Lakra WS, Ayyappan S. Recent Advances in Biotechnology Applications to Aquaculture. Asian-Aust. J. Anim. Sci. 2003; 16(3):455-462.
2. Carolsfeld J, Powell JF, Park M, Fisher WH, Craig AG, Chang JP *et al*. Primary structure and function of three gonadotropin-releasing hormones. Endocrinology. 2000; 141:505-512.
3. Robinson TC, Tobet SA, Chase C, Waldron T, Sower SA. Gonadotropin-releasing hormones in the brain and pituitary of the teleost, the white sucker. Gen Comp Endocrinol. 2000; 117:387-394.
4. Pandian TJ, Koteeswaran R. Ploidy induction and sex control in fish. Hydrobiologia. 1998; 384:167-243.
5. Lakra WS, Das P. Genetic engineering in aquaculture. Indian. J Anim. Sci. 1998; 68(8):873-879.
6. Palmiter RD, Brinster RL, Hammer RE, Trumbauer ME, Rosenfeld MG. Dramatic growth of mice that develop from eggs microinjected with metallothionein-growth hormone fusion genes. Nature. 1982; 30:611-615.
7. Hasan MR. Nutrition and feeding for sustainable aquaculture development in the third millennium. In: Aquaculture in the third millennium (Eds. Rohana, PS, Pedro BB, Michael JP, Coutney HS, McGladdery E, Arthen JR), 2001, 193-219. NACA/FAO publications.
8. Ghosh KK, Chakraborty S, Sen K, Ray AK. Effects of thermo stable bacterial α-amylase on growth and feed utilization in rohu, *Labeo rohita* (Hamilton) fingerlings. The Israeli Journal of Aquaculture. 2001; 53(3, 4):101-109.
9. Verschuere L, Rombaut G, Sorgeloos P, Verstraete W. Bacteria as Biological Control Agents in Aquaculture. Microbiology and Molecular Biology Reviews. 2000; 64(4):655-671.
10. Mai GC. Genetics in Tilapia culture. In: Subasinghe S, Singh T. (EDs) Proceedings of the Tilapia, 2001, International Technical and Trade Conference. 28-30 May Kuala Lumpur, Malaysia, INFOFISH, Kuala Lumpur, Malaysia, 2001, 136-148.
11. Mair GC. Tilapia Genetics and Breeding in Asia. In: Guerrero III RD and Guerrero-del Custillo MR (eds.) Tilapia farming in the 21st Century. Proceedings of the International Forum on Tilapia Farming in the 21st Century (Tilapia forum,) Phillipine Fisheries Association, Inc., Losbanos, Laguna, Phillipines. 2002; 100-123, 1845.
12. FAO/NACA/CSIRO/ACIAR/DFID (Food and Agriculture Organization of the United Nations Inland Water Resources/Network of Aquaculture Centres in Asia-Pacific/Commonwealth of Scientific and Industrial Research Organization/Australian Centre for International Agricultural Research/Department for International Development of the United Kingdom. Expert Workshop on DNA-based Molecular Diagnostic techniques: Research Needs for standardization and validation of the detection of Aquatic Animal health, pathogens and diseases. 7th – 9th February, 1999. Rome, Italy.
13. Lakra WS. Cryogenic preservation of fish spermatozoa

and it application to aquaculture. Indian J Cryogenics. 1993; 18(1-4):171-76.

14. Harvey B. Salmon gene banking: a conservation opportunity. Publ. World. Fisheries Trust, Canada, 1995, 83.