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Application Of Biotechnology In Aquaculture

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Abstract:

Biotechnology plays a major role in fish production through various techniques such as selective breeding , genetic engineering to enhance the growth rate and disease resistance in aquaculture . Fish culture business is fastest-growing sector of agricultural fields. The consumer demand for fish products continues to rise at an alarming rate. At the same time, wild fish stocks are declining at a fast pace due to over-fishing – a major concern. Every year, aquaculture contributes more than 18 million tons of fish and shellfish to the world's food supply. The increased public demands for fish, coupled with the dwindling natural marine habitats, have led scientists to study ways in which biotechnology can help boost fish and shellfish production. application of biotechnology allows researchers to identify and combine traits in fish and shellfish to enhance the productivity and quality . This article delves into the various ways in which biotechnology is applied to aquaculture and what the future holds for fish farming. The field of aquaculture has been revolutionized by the introduction of biotechnology. With the help of advanced genetic research, scientists have been able to enhance the growth of fish production.

Keywords: biotechnology , genetic engineering,aquaculture,fish production, disease.

1.Introduction

Aquaculture is a fastest growing sector throughout the world, to enhance the productivity of fishes' species is involved by biotechnology to produce hybrid varieties and disease resistant fishes Biotechnology is the major tool and contributes various methods for the development of fisheries and aquaculture, and food industry. Like, the big public demand for seafood and decreasing natural marine habitats have, like, encouraged scientists to study ways that biotechnology can increase the production of marine food products, and making aquaculture as increasing division of animal research. Biotechnology, like, allows researchers to essence and combine traits in fish and shellfish to increase productivity and improve quality! researchers are investigating genes that will increase the production of natural fish growth pa.rameters as well as the natural fortification compounds of aquatic organisms use to defense against pathogen of infections. Present day biotechnology is making major contributions and implies, like, substantial challenges to aqua farming and fisheries evolution, Biotechnology, like, perceives that modern bio technologies, like, should be used as addition to and not as change for modern technologies in clearing problems, and the applications must need as rather than technology-driven. The application of modern biotechnology to improve the production of aquatic species holds, like, great potential not only to meet demand but also to improve aquaculture. Genetic modification and biotechnology also hold,

like, tremendous potential to improve the quality and quantity of fish reared in aquaculture. There is a growing demand for aquaculture; biotechnology, like, can help to meet this demand. Biotech aquaculture also offers, like, environmental benefits. When an approaching combines with other technologies for the fabrication of food, agricultural goods and services, biotechnology can be of standard, like, providing the needs of an enhancing and increasingly urbanized population in the next millennium. effective growth and appliance of biotechnology are possible only during a wide research and expertise base in the life sciences, breeding, biochemistry, physiology, pathology, and genetics of the manipulated organism exists. Benefits offered by the new technologies, like, cannot be fulfilled without a continued commitment to basic research. Biotechnological activities must, like, be fully involved into a research background and cannot be taken out of context if they are to succeed. Biotechnology, currently, offers many, like, promising opportunities for advancements in aquaculture and related fields. It's, like, essential for scientists to continue exploring new possibilities and methods to further enhance the benefits of biotechnology in sustainable food production and environmental conservation efforts.

2.Materials and methods

2.1 Biotechnology technique in fish breeding

Biotechnology enhances the hatchability and production rate in fishes , modern biotechnology has successfully developed breeding hormones such as gonadotropins releasing hormones (GnRH). GnRH is a major regulator and central indicator of reproductive cascade in vertebrates. it is first isolated from pig and ship hypothalamic with the ability to induce pituitary release of luteinizing hormone (LH) and (FSH) follicle stimulating hormone(Schally et al,1973). the only one model of GnRH is identified in placenta of mammals including homo sapiens as the neuropeptide stimulating the release of LH and FSH. in non-mammalian species 12 GnRH variants have structurally elucidated , among them 7-8 different forms have been isolated from fish species (Halder et al.1991;Sherwood et al .1993 ; king and miller 1995) , according to different biological activities number of chemical analogues had prepared GnRH analogue profusely used now a days in fish breeding and marketed commercially by the name of ovaprim, the breeding of fish species is successfully developed by GnRH technology.

2.2 Chromosomal engineering

Chromosome set manipulation technique is to induce the polyploidy and uniparental chromosomes inheritance have been applied extensively in cultured fish (Pandian and koteswaran , 1998; Lakra and das 1998),these techniques developed in the improvement of hybrid fish as they provide rapid approach in gonadal sterilization , sex control improvement of hybrid varities in diploid meaning that they possess one or more additional chromosomes set.in teleosts , techniques for inducing sterility include exogenous hormone treatment (hunter and Donaldson,1983) and tripoidy induction (thorgarad ,1983) , the application of hormone treatments , however could be limited by government regulation and lack of consumer acceptability of hormone introduced fish products , triplodiy can be induced by exposing eggs to physical or chemical treatment after fertilization to introduce of polar body (purdom1983;ihssen et al.1990)triploid fish species are sterile because the failure of homologous chromosomes to synapse correctly during meiotic division .steps involved in triplodiy is exposing fertilized egg to temperature stock , hydrolytic pressure shock or chemical such as cytochalasim -b- or nitrous oxide , triploid also developed by crossing tetraploids and diploids. androgenesis is the process by which commercial application done in aquaculture ,it can also use in developing homozygous lines in fish and the recovery of lost genotypes from cryopreserved sperms , androgenetic individuals are few developed from cyprinid families and chichilids.

2.3Transgenic fish production

Transgenic is referred as introduction of exogenus gene/DNA in the host genome resulting in its maintenance, transmission and gene expression. The technology provides an excellent opportunity for modifying or improving the genetic traits of demandable important fishes , the idea of developing transgenic animals became popular (palmitter et al.1982) first produced transgenic mouse by introducing metallothionein human growth hormone fusion gene (mT-hGH)into mouse egg. Resulting in rapid growth .the first transgenic fish was produced in China claimed the transient expression in putative transgenic(Zhu et.al 1985) although they gave no molecular evidence for the integration of the transgene the technique has successfully applied to number of fish species, some studies have reveled development of growth in adult salmon in an average of 3-5 times during few months of growth , the most development tool for the future to transgenic fish production in undoubtedly in the development of the embryonic stem cell (ESC) technology . the cells are undifferentiated

and remain totipotent so they can be manipulated in vitro and subsequently introduce in embryo, this would facilitate the new genes to be stably introduced or eliminated (melamed et al.2002) .an increased resistance of fish to cold temperatures has been another subject area of research in transgenic fish for the past years (fletcher et .al 2001).the advancement of the technology include more efficient technologies and targeted gene transfer technologies such as embryonic stem cell transfer with suitable promoters to the direct transfer technologies information about nutritional requirements for the successful production of transgenic fish

2.4 Selective breeding

The basis of selective breeding is to select individuals that possess a high additive genetic value for a desired phenotype (trait) as parents such that they can pass on their superior genes to progeny in following generations. In this way it should be possible to shift the mean value of the target trait for the cultured population in the desired direction in each successive generation. In selective breeding programs it is necessary to minimize loss of genetic variation (e.g. that might arise through inbreeding) during this process to ensure that genetic gains are achieved and sustained for many generations. Given the long-term commitment implicit in initiating selective breeding, it is imperative that the stock to be improved is part of a commercially significant and sustainable aquaculture sector. It is therefore important to review the development and future potential for the sector in question prior to investing in any long-term genetic improvement strategy. it is a major step in introduction for a selective breeding programme is the development of an approx stock. To maximize the potential for long term genetic gain and enhancement of culture performance this founder stock should be highly genetically variable and should be based primarily on the best performing stocks available (where performance data is known or can be obtained). In reality this will likely involve the creation of a composite founder stock using source ,the major first step in introducing a selective breeding programme is the identification or enhancement of an appropriate stock. To maximize the potential for long term genetic gain and enhancement of culture performance this founder stock should be highly genetically variable and should be based primarily on the best performing stocks available (where performance data is known or can be obtained). In reality this will likely involve the creation of a composite founder stock using source.

2.5 Hybridization and cross-breeding

Hybridization is breeding individuals from two separate species while crossbreeding is the mating of two different varieties/stocks within a species. Both the crosses are commonly prepared with an objective of maintain a non- additive genetic variance by identification of significant creative heterosis, also known as “hybrid vigour”, for commercially important traits. exhilarating heterosis happen when the hybrid or crossbreed performs better than the average of the two parental species or stocks. In realistic terms heterosis only becomes significant when the hybrid or crossbred performs better than either brooder species or stocks. When evaluating heterosis it is important to evaluate reciprocal crosses as heterosis can vary depending on the maternal or paternal parent species stock. Both cross-breeding and hybridization are relatively simple techniques to master and can have an immediate impact on performance within one generation and can have an immediate impact on performance within one generation. However, this benefit is finite and only optimized in the specifically targeted hybrid cross between the original parental lines, unless the parental lines are then selected over generations for their general or specific combining ability, resulting in complex and relatively slow breeding programmes.

3.Result and discussion

Biotechnology plays a vital role in development of transgenic fish which is the key success for the enhancement of fish production but in the cold-water species there is major problem in developing the transgenic fish , some marine teleosts have high levels (10-25mg/l)of serum antifreeze antifreeze proteins(AFP) the isolation is characterization and regulation of these antifreeing protiens particularly of the winter. The development of stock by introduction of gene may be the beneficial for commercial aquaculture .

References

1. Griffith, R, Orr. J. Adam.A and Barber, I, 2000. DNA sex identification in the three spined stickleblack. J, fish Biol, 57: 1331-13334.
2. Halder ,S Sen , Bhattachery, S, Ray A.K, Ghosh, A and Jhingran, A,G, 1991. Induced spawing of IMC and maturation of a perch and a catfish by murrel gonadotropin releasing hormone , pimozide and calcium aquaculture, 97:373-382.

3. Hew,C.L.,Fletcher,G.,and Davies,P.L.,1995.Transgenic salmon:tailoring the genome for food production.J.Fish Biol .,47:1-9.
4. Baras,E.,C.Prignon,Gohoungo,G.and Melard, C., 2000.Phenotypic sex differentiations of blue tilapia under constant and fluctuating thermal regimes and its adaptive and evolutionary implications. J. Fish Biol. 57:210-223.
5. Billington N, and Hebert, P.D. N, 1991.Mitochondrial DNA diversity in fishes and it implication for introductions.Can.J.Fish. Aquat.Sci.,48(5I):80-94.
6. Fiecther, G.L, Hew, C.L,Davies, P.L,2001. Antifreeze protein of teleost fishes Anuu,Rev . Physiol, 63:359-390.
7. Gilberg,A ,Mikkelsen H,Sandaker,E, Ringo, E, 1997. Probiotic effect of lactic acid bacteria in the feed on growth and survival of fry of Atlantic cod. Hydrobiologia, 352(1- 3):279-285.
8. Blaxter,J ,H. S, 1953 Sperm storage and cross fertilization of spring and autumn spawning herring .Nature ,London,172:1189-1190.
9. Bonger,A.B.J, Int Veld EPC, Abo-Hashema,K, Bremmer,I.M, Eding,E.H,KOmen J and Richter, C.J.J, 1994. Androgenesis in common carp (cyprinus carpio) using UV Irradiation in a synthetic ovarian fluid and heat shock, aquaculture.122:199-132.
10. Carolsfeld J, Powell, J.k, Park,M Fisher. W, H Craig A.G, Chang, J.P. River, J,E and Sherwood N.M, 2000/ Primary structure and function of three gonadotropin releasing hormone. Endocrinology, 141: 505-512
11. Chourrout, D, 1987. Genetic manipulation in fish:review of method. In k Tiews (ed), selection, hybridization and genetic Engineering in aquaculture Bordeaux Heenemann , Berlin, 2:111-126 . Chourraut, D, Chevassus, B, Krieg F. Happe, G. and Renard P, 1986. Producation of second-generation triploids and tetraploid rainbow trout by mating tetraploid males and diplod female . potentials of tetraploid fish. Theror. Appl.gene , 72:193-206.
12. Diwan, A.D.and Kandasami, D, 1997. Freezing of viable embryo and larvae of marine shrimp P.Semisulcatus de haan. Aquaculture research.28:947-950.
13. Gomelsky Boris, Mims, S.D and Onders Richard J. 2000. Induced gynogenesis in Black Crappie. North American journal of aquaculuture, 62:33-41.
14. Karunasagar,I. and Karunasagar,I.,1999.Diagnosis treatment and prevention of microbial diseases of fish and shellfish.Curr.Sci.,76:387-399. Lakra,W.S. and Das ,P.,1998.Genetic engineering in aquaculture ,Indian .J.Anim.Sci.,68(8);873-879
15. Baroiller,J.F.,Guiguen,Y. and Fostier , A.,1999. Endocrine and environmental aspects of sex differentiation in fish.Cellular and molecular Life Sci.,55:910-931.
16. Battacharya s.,Dasgupta,S, Datta,M ,and Basu, D, 2002 Biotechnology input in fish breeding .Indian journal of biotechnology,1:29-38.
17. Abella TA, Palada MS, Newkirk GF, 1990: Within family selection for growth rate with rotation mating in *Oreochromis niloticus*. Proceedings of the 2nd Asian Fisheries Forum. Asian Fisheries Society, Manilla, Tokyo, Japan, 17–22 April 1989, pp. 515–518.
18. Gupta, M.V. and Acosta, B.O. (2001b). Networking in aquaculture genetics research. In: M.V. Gupta and B.O. Acosta (eds.). Fish genetics research in member countries and institutions at the International Network on Genetics in Aquaculture. ICLARM Conference Proceedings, , pp. 1–5.