Ecofarming
e-Magazine for Agriculture and Allied Sciences
http://www.rdagriculture.in
e-ISSN: 2583-0791
Ecofarming Vol. 02(04): 210-213, 2022

Transgenic Techniques

A contemporary fish producing technology

Ashish Shivji Bhuva

College of Agriculture
Anand Agricultural University, Jabugam-391 155, Gujarat, India

Email: ashishshivji91@gmail.com

Received: **September 01, 2022;** ***Revised:*** **September 04, 2022** ***Accepted:*** **September 04, 2022**

Introduction

Since the first transgenic fish were made in China in 1985, numerous transgenic fish have been created utilising a range of transgenes, techniques, and species. Early research centred on producing novel fish strains with commercially desirable traits and advancing transgenic technology, with an emphasis on enhancing growth. Transgenic organisms are those whose genomes have successfully incorporated a

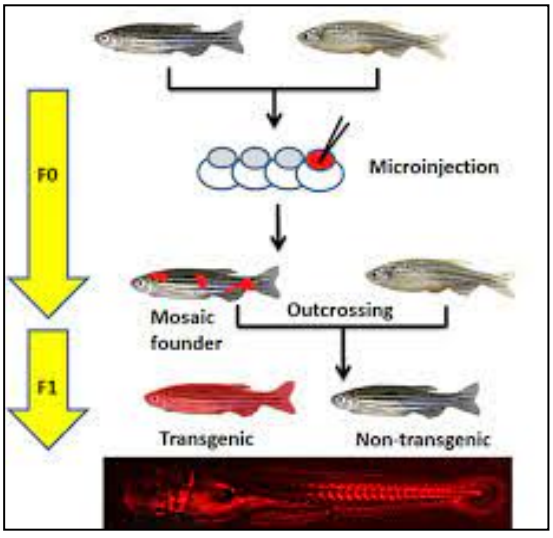
transgene that was introduced intentionally. As of 2013, over 50 fish species had undergone genetic modification. The majority of the alterations have been made to food species such Common Carp, Tilapia and Atlantic salmon (Cyprinus carpio). There are numerous fish species being examined for gene transfer experiments, and they can be divided into two categories: Model fish for fundamental research and aquaculture animals. The most popular fish for eating are Channel Catfish (Ictalurus punctatus), Tilapia (Oreochromis spp.), Salmon (Salmo spp.), and Medaka (Oryzias latipes), whereas Goldfish (Carassius auratus) and Zebra fish (Danio rerio) are used for fundamental research.

Fig 1 (a). Transgenic Glofish

Fig 1 (b). Transgenic Green Tetra Fish

Methods in the Production of Transgenic Fish

Several significant actions are routinely conducted in order to produce the desired transgenic fish. An acceptable fish species must first be chosen based on the purpose of the research and the accessibility of the fish-holding facility. Making a specific gene construct is the next stage. An important gene product is encoded by a structural gene in the gene construct. Third, for the transgene to be permanently incorporated into the DNA of each cell, the gene construct needs to be injected into developing embryos. Fourth, a screening process for identifying transgenic people must be implemented because not all instances of gene transfer are successful.



Electroporation Method

The most effective method of gene transfer in fish has been found to be electroporation because a large number of fertilised eggs may be treated in a short amount of time. The cell membrane is punctured by a series of brief electric pulses during electroporation, allowing the transgene to enter the cytoplasm and then be transported

by the cellular machinery to the nucleus. Electroporation has taken over as the preferred method for gene transfer in fish systems in many labs due to its effectiveness, rapidity, and simplicity.

Microinjection Method

The microinjection procedure has been used to produce transgenic fish successfully because it is straightforward and repeatable. The most popular method of fish gene transfer, microinjection enables delivery of the transgene directly into the nucleus. It was discovered that the DNA injected into the cytoplasm of fertilised zebra fish eggs integrated into the fish genome and was handed down to the following generations. In zebra fish, the frequency of germline transmission of a microinjected DNA may reach 20%.

Method of Retroviral Infection

Retroviruses have reportedly been utilised successfully to transfer genes to fish.

Advantages of Transgenic Fish

The development of human therapeutics, experimental models for biological research, environmental monitoring, ornamental fish, and aquaculture are just a few of the uses for transgenic fish that have been developed. Reduced feed waste and effluent from fish farms are two examples of how transgenic fish's improved feed conversion efficiency has led to economic and possibly environmental advantages. In order to better understand the genetic, physiological, and ecological effects of growth promotion, transgenic strains serve as crucial model systems. Growth of transgenic tilapia is significantly faster than that of non-transgenic tilapia without extra copies of the trout growth hormone gene. Researchers have employed transgenic fish to study how genes are regulated during development, increase cold tolerance, hasten growth, and enhance feed utilisation. Applications of Transgenic Fish Technology in Research Transgenic fish are used in research covering five broad areas:

- Improving fish characteristics that are available for purchase.
- Making proteins that are crucial to biomedicine in them as bioreactors.
- Using them as indicators for contaminated water.
- Creating innovative models of non-mammalian animals.
- Studying functional genomics.

Environmental Impact of Transgenic Fish

Concerns regarding the possible effects of GM organisms escaping from aquaculture operations have been raised by several scientists and environmental organisations. Scientists and opponents of GM fish are concerned that undesirable genes would spread by interbreeding with wild populations of the same species. Wild fish may be put in danger due to increased competition or predation from escaping transgenic fish. The size of the natural population, the number of escaped fish and their genetic strain, as well as regional environmental factors, would all have a role in determining the outcomes of such competition. According to the Food and Drug Administration(FDA), only sterile GM fish might be used in ocean enclosures.

Conclusion

The future success and adoption of transgenic fish will depend on the ability to successfully demonstrate a potential absence of environmental risk, food safety, suitable government regulation, labelling, public education, and the development of transgenic fish genetic sterilisation. Transgenic technology is rapidly evolving. To achieve widespread consumer acceptance of transgenic fish from an environmental perspective, as well as maybe in reference to how "organic" a transgenic fish is, appropriate, well-executed public education may be necessary. Future research should concentrate on DNA sequences from fish rather than mammals to increase public acceptance and prevent sequences of bacterial or viral origin. On the other hand, consumers and environmentalists are concerned about its safety.

References

1. Chen T.T. and Powers D.A., (1990). Transgenic fish. Biotechnology 8:209-215. 2. Chen T.T., Vrolijk N.H., Lu J.K., Lin C.M., Reinschuessel R. and Dunhasm R.A., (1996).
2. Transgenic fish and its application in basic and applied research. Biotechnology Annual Review 2:205-236. 3. Duan M., Zhang T., Hu W., Sundstrom L.F., Wang Y., (2009).
3. Elevated ability to compete for limited food resources by 'allfish' growth hormone transgenic common carp (Cyprinus carpio). Journal of Fish Biology 75:1459-1472. 4. Fletcher GL and Davis PL. 1991.