Breaking News :

Marine Pearl Production : CMFRI develops Tissue Culture Technology

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Enshrined as Pearl city, Tuticorin in Tamilnadu was at one time a converging point for natural pearls extracted from the pearl oysters taken from pearl beds (Paars) of Gulf of Mannar.

In the olden days, the abundance of pearl oysters in their natural beds (Paars) in the Gulf of Mannar, generated periodical pearl oyster fishing rounds and the output was the source of a flourishing oriental pearl trade that prevailed then.

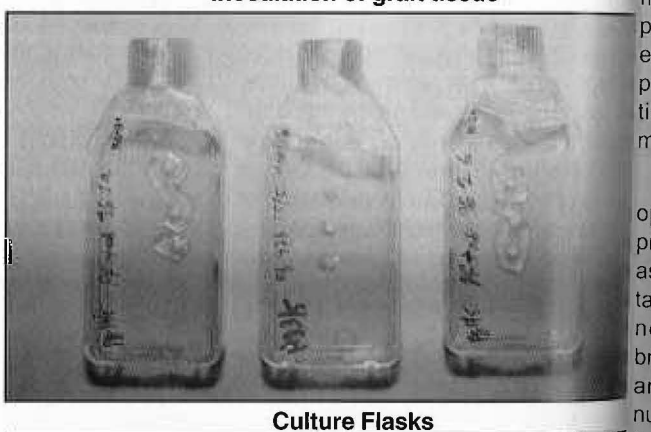
The precise origin of the pearl fisheries of the Gulf of Mannar is not on record but there are some known historic evidences of pearl fisheries that prospered in the Gulf to trace their existence since 550-540 B.C. The activity continued for centuries and until recently. The last pearl fishery was conducted in the Gulf in the year 1961. Since then the pearl oyster resources in the Gulf of Mannar had been on an inexorably declining trend. As a result of this, the fishing for pearl oysters in the gulf had come to be discontinued. So much so, today, the availability of natural pearls has become a rarity.

In order to revive the glory of the Indian pearls, the Central Marine Fisheries Research Institute initiated efforts to produce cultured pearls, utilizing the available pearl oyster resources of the Paars, under the research scheme on pearl oyster culture taken up in 1972. In a duration of one year, in 1973, the Institute developed under the scheme the technology for the production of cultured pearls for the first time in the country.

As is known, natural pearl formation takes place in the body of the pearl oysters. While this is so, cultured pearls too are also produced in the body of the oysters in selected places in the sea through placement of certain holding contrivances on which oysters with nuclei imbedded in them are placed to grow. In the open water habitat, both the natural and culture stocks happen to be exposed to chances of mortality. An example of this, among others, is a recent outbreak of viral diseases in the sea habitat of these oysters in Japan which killed the entire stock of pearl oysters. This has caused great concern particularly among the Japanese pearl culture enterprises. This concern is understandable but control of such diseases in the natural habitat is considered as impossible.

In the light of the hazards that sea-based pearl oyster / pearl production efforts face, one option that is available for the production of culture pearls is the taking up of tissue culture under controlled conditions. Tissue culture can provide sustainable production of pearls. Arriving of this conclusion, the Japanese scientists embarked on oyster tissue culture for *in vitro* pearl production. While they primarily con

Inoculation of graft tissue



Culture Flasks

Shell bead nucleus coated with nacreous layer

centrated on pearl mantle tissue culture, they extended the same technique to other marine pearl producing molluscs. There was also fundamental research undertaken on formulation of suitable culture media and other saline solutions for culture of pearl oysters and other marine molluscs. However, no published reports could be come across on *in vitro* pearl production through mantle tissue culture.

The Establishment of Tissue Culture Laboratory in India: In the above mentioned background, the Central Marine Fisheries Research Institute has established the first tissue culture laboratory for marine molluscs at its Tuticorin Research Centre as part of its on going research efforts for the production of *in vitro* cultured pearls.

Organization of Culture: In the tissue culture laboratory, pieces of the mantle procured from life oysters / abalones are cultured in petri dishes or culture flasks using appropriate nutrient media. The culture of mantle tissue of pearl oysters / abalone in the laboratory enabled a detailed study of many aspects of cells such as their proliferation, types, migration, behaviour and multiplication.

The tissue culture technology developed at the Institute is now under the process of patenting. For this reason as required under patent rules, the details of the technology developed could not be presented here. However, broadly stated, the technology revolves around the placement of shell bead nucleus and a piece of mantle tissue in the culture flask containing an appropriate culture medium. The basic studies on the secretion and deposition of nacreous layer on the shell bead placed in the pearl oyster as well as in abalone simultaneously have been successfully completed. The studies have shown that the nature of secretion and pattern of development are specific to each of these species, although they are cultured in the same medium. The cells are seen to develop micro layers over the bead and as a result of this an *in vitro* pearl is produced.

There are a few earlier studies carried out elsewhere on live pearl oyster. During these studies addition of crystals was noticed in the shell under repair phase resulting eventually in the formation of nacreous and prismatic layers. There are some other studies which described the shell structure of pearl oyster and other molluscs. As part of the present study, culture of tiny pieces of a mantle tissue was carried out in the laboratory which enabled the observation of pearl formation. Such a study has not been reported by any other workers and hence the breakthrough achieved at CMFRI's laboratory deserves to be highlighted as an outstanding achievement. In Japan, although the tissue culture for *in vitro* pearl production is being carried for several years, there has been no report to indicate any in vitro pearl production success so far. However, there are a few reports on formation of crystals. In this background, the progress achieved on tissue culture at CMFRI within a short period of about 6 years is rated as remarkable. This success has paved the way for in vitro pearl production on a commercial scale and also provides opportunities of adopting this technique in respect of other pearl producing molluscs.

Highlights of the Breakthrough: The life span of pearl oyster is about 6-7 years. The oyster can be used for the production of cultured pearls when it is about one and a half year old. During the remaining life span of four and half years a maximum of three pearls can be produced from a surviving oyster. In contrast, in the present *in vitro* technology a tiny piece of mantle tissue of pearl oyster / abalone is found to be capable of producing a pearl. By sacrificing just one oyster, numerous pieces of mantle tissue can be obtained and each of such pieces will be capable of producing an *in vitro* pearl. Thus the technology developed opens up enormous potential for the production of pearls in a full-fledged tissue culture laboratory. Another aspect is that *in vivo* pearl production provides no certainty of pearl quality or opportunity for manipulation of pearl quality as the process is totally governed by extrinsic and intrinsic factors. The *in vitro* technology affords ample chance for manipulation of pearl quality, unlike *in vivo* production.

The *in vitro* technology now developed at CMFRI can be extended to other pearl producing molluscs. Further, this technology has the potential to pave the way for the production of pearls of various colours from different species of molluscs. Possibility of producing black pearls from *Pinctada margaritifera*, rainbow colour pearls from abalone and blue tinged pearls from winged oysters is high. With further refinement and upgradation, the day is not far off when high-tech tissue culture laboratories would be able to produce marine pearls of desired shape, size and colour. The progress made so far by CMFRI is only a small beginning and the Institute looks forward to reaching greater heights of endeavour in this line of work in the days to come.

The authors desire to record their sincere gratitude and indebtedness to Prof. (Dr.) Mohan Joseph Modayil, Director, CMFRI, who is the main source of inspiration and encouragement to us all through the work. They also gratefully acknowledge his support which was vital for the success that we could achieve.

Fish Immunology Centre

A Centre for Fish Immunology has been opened at the Lady Doak College, Madurai, Tamilnadu here.

According to Mr. Dinakaran Michael, Director, the centre would evolve immuno-prophylactic measures for freshwater finfish aquaculture, to extract immunostimulants from medicinal plants, evolve immunological indicators for environmental pollution and disease out-break.

Already the centre has been carrying out a Rs. 30 lakh project for developing immunological indicators, under an Indo-German project, in collaboration with the Hannover University and supported by Volkswagen Foundation. A Rs. 20 lakh project is also in taking shape supported by the Department of Biotechnology, Government of India, for developing immunostimulants from Indian medicinal herbs, he added.