CYTOGENETIC AND GENETIC STUDIES ON THE CHOCOLATE MAHSEER, *ACROSSOCHEILUS HEXAGONOLEPIS*

ABSTRACTS

BY

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The use of aquatic resource has been a challenge to man throughout his existence on earth because approximately two-third of our planet is covered by water and most of it supports fish life. Fish contributes about 1% of the total food supply of the world. The part played by fish in the diet varies greately from country to country. In a country like India, since the intake of meat and milk is low fish has special importance as a supplement to ill-balanced diets and are obviously subjected to maximum and often ruthless exploitation. In addition, other stresses like habitat degradation due to aforestation, pollution etc. have resulted in a rapid decline of the fish stocks especially mahseer species. Therefore, is an urgent need for the conservation of fish genetic resources. There are various possible approach towards conservation of fish genetic resources, *i.e.*, genetic stock identification of fish population, stock improvement, monitoring genetic changes in their habitat etc. Biochemical genetic technique offers accurate methods for identifying discrete breeding populations, estimating contribution to stock mixtures, indicating problem in fish culture, recognizing and quantifying hybrid populations and providng insights into conservation problems.

Mahseers are important game fishes of India. They grow to a considerably large size and are generally found in mountainous streams and rivers. The commonly found mahseers in India are *Tor khudree, T. mosal, T. mossulah, T. neilli, T. progeneius, T. putitora, T. tor* and *Acrossocheilus haxagonolepis*.

There is a paucity of information on the cytogenetic and genetic structure of the indigenous game fish, *A. hexagonolepis* in the North-Eastern region of India. Such a knowledge, is of utmost importance not only from the academic view point, but also in its utility in increasing technological efficiencies of the fishery evolving judicious management measures. Keeping in view, the basic necessity to have a knowledge on the cytogenetic and genetic background of the chocolate mahseer fish and hence, on a virtual absence of such informations, a study has been undertaken to elucidate on the cytogenetic and genetic structure of chocolate mahseer species, *A. hexagonolepis* from the North-Eastern region of India.

The study pertains to the specimens collected from two different sites *viz.*, (1) The Pagladia river (Subankhata, Assam; 91° 28' Latitude and 27° 40' Longitude). (2) Umiam reservoir (Barapani, Meghalaya; 91° 56' Latitude and 24° 34' Longitude). The collections were made during May 1993 through May 1995 from Umiam reservoir, while from the Pagladia river during the month of March 1993, 1994 and May 1995. The results obtained during the present study has been presented in the thesis entitled, "Cytogenetic and genetic studies on the chocolate mahseer, *Acrossocheilus hexagonolepis*". The thesis containing 114 pages, with 20 Tables and 34 Figures, has been divided into two chapters. The first chapter deals with the cytogenetic aspects of chocolate mahseer. The second chapter contain the genetic structure of the chocolate mahseer *A. hexagonolepis*.

The following are the important results obtained during the present investigations and embodied in the thesis.

Chapter I. Cytogenetic study: We have reported the diploid chromosome number and karyotype of *A. hexagonolepis* and have also suggested that *A. hexagonolepis* evolved from the ancestral group containing 48 chromosome number by the process of polyploidization event. The karyotype 2n = 96; chromosome formula n = 7m + 15sm + 9st + 17t, was subsequently attained through Robertsonian alteration coupled withh pericentric inversion.

Chapter II. Genetic study: We examined 1237 spcimens sampled from the two sites and we have selected twelve enzymes *viz.*, Adenylate kinase (AK), Alcohol dehydrogenase (ADH), Glucose 6-phosphate dehydrogenase(G6PDH), Glutamate dehydrogenase(GDH), Glycerol 3-phosphate dehydrogenase(G3PDH), Hexokinase (HK), Hexose 6-phosphate dehydrogenase (H6PDH), Malate dehydrogenase (MDH), Malic enzyme (ME), Phosphoglucomutase (PGM) and Xanthine dehydrogenase (XDH) for our present work.

ADH, ME and GDH enzyme showed tissue specific activity, the former being expressed in liver and latter one in muscle tissue. While the expression of other enzyme has been observed in different tissues.

We have observed that G6PDH, LDH-1, LDH-2, ME and PGM-2 (Umiam reservoir) were all represented as a single invariant band on the gels, each of these enzymes is coded by single locus.

The enzymes ADH, G3PDH-2, HK, H6PDH, LDH-3, MDH and PGM-1 showed double banded pattern on the gels, each of these enzyme are coded by single locus with an allelic variant.

GDH appeared as two isozymes of different electrophoretic mobility. No variation in banding pattern was observed. Two loci were assumed responsible for the genetic control of this enzyme.

The dimer enzymes G3PDH and XDH in chocolate mahseer was represented by four banded and three banded pattern respectively. Two loci were responsible for the control of these enzymes.

We have observed the maximum number of homozygous individuals in the Umiam reservoir and its reflected in the low level of average heterozygosity (0.909) and alleles per locus (1.412) in the population comparable to the values observed in the Pagladia riverine population. MDH locus which was polymorphic in Umiam reservoir population were observed to be monomorphic in the Pagladia river population.

The maximum number of homozygous individuals were found in Umiam reservoir. This may perhaps if correlated with ecological parameter (*i.e.*, temperature Vs heterozygosity). Overall water surface temperature also shows a positive correlation and is statistically significant ($Y = 23.141 + 0.468x$; $r = 0.631$). We also observed but statistically insignificant positive correlation between the mean heterozygosity and body weight of fish ($Y = 76.058 = 0.029x$; $r = 0.0497$).

The phenetic relationship between Umiam reservoir and the Pagladia river population were estimated through comparison of genetic similarity ($I = 0.918$)/distance ($D = 0.121$) indicating low level of genetic distance. A 29% of gene duplication was noticed thus supporting the tetraploid nature of our fish *A. hexagonolepis*.