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Genetic Similarity Frequency and DNA Polymorphism between Common Carp and Israeli Carp Using Polymerase Chain Reaction-Random Amplified Polymorphic DNAs

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ABSTRACT

Common carp(*Cyprinus carpio*) and Israeli carp(C. *carpio*) samples were obtained from a aquaculture facility in the Kunsan National University, Korea. Genomic DNA was isolated from the common carp and Israeli carp representing genetic characteristics and genomic polymorphisms by polymerase chain reaction amplification of DNA as arbitrary primers. There were observed a total of 90 species-specific genetic markers within Israeli carp. On average, each random RAPD primer produced amplified 7.9 products from 1 to 17 bands. An average genetic similarity within Israeli carp showed 0.60±0.05. The average level of bandsharing was some 0.57 ±0.03 between common carp and Israeli carp. Accordingly, two carp species were genetically a little distant. The electrophoretic analysis of PCR-RAPD products showed high levels of variation between two fish species. The RAPD polymorphism generated by this primer may be used as a genetic marker for species or lines identification in important aquacultural carp.

INTRODUCTION

Genetic polymorphisms are playing an increasingly important role as genetic markers in many fields of animal, plant and microorganism breeding. Identification of individual or commercially-important fish species is necessary for efficient selective breeding and broodstock management, and for the measurement of various traits. The development of genetic markers in fish is needed to improve the efficiency of breeding by marker-assisted selection and for the identification of economically important genes such as disease resistance genes, antifreezing peptides genes and growth hormone genes. More recently PCR using arbitrary primers has been applied to the inter- and intra-species differentiation (Rocha-Olivares, 1998). In this study, DNAs isolated from common carp(*Cyprinus carpio*) and Israeli carp(C. *carpio*) were analyzed by 24 random amplified polymorphic DNA(RAPD) primers in order to identify the genetic relationships of two species and genomic polymorphisms within the species, and to develop the species-specific genetic markers.

MATERIALS AND METHODS

Common carp(*Cyprinus carpio*) and Israeli carp(C. *carpio*) DNA samples were obtained from a aquaculture facility in the Kunsan National University, Korea. Preliminary RAPD analysis was

performed on genetic DNA samples from each carp using 24 different random rimers. In order to achieve reproducible results, DNA extraction should be performed with highest quality reagents. Amplification was performed in a DNA Thermal Cycler. Amplification products were separated by electrophoresis in 1.4% agarose gels with TBE and detected by staining with ethidium bromide. The gels were illuminated with UV light and taken photographs by photoman system. Bandsharing calculation of DNA sequences was somewhat modified the formula of Jeffreys and Morton(1987). If the comparison between the three lanes, the formula would be: BS=3(Nabc)/(Na+Nb+Nc) and so forth.

RESULTS AND DISCUSSION

The number of products generated per primer varied from 1 to 17 with an average of 7.9. It was used DNA extracted from common carp and Israeli carp which had the genome size of from $10^2$to 10^3 bp. The bands in the molecular weight range from 0.72 to 0.872 kilobase pairs generated by 9 random primers were observed(Fig. 1). The Inter-species specific variation was revealed in the band patterns ranged in 234 and 194bp, respectively. Primer No. 18, detected the DNA bands being high in 603bp were present in every individuals of 2 species. In our study, 38% of the random primers appeared amplified polymorphic bands. 9 primers produced amplified fragments which were consistently polymorphic between common carp and Israeli carp. 5 random primers produced the sizes of polymorphic DNA bands ranged from approximately 193 to lower than 603 base pairs within Israeli carp. There were observed a total of 232 species-specific genetic markers between common carp and Israeli carp. On average, each random RAPD primer produced amplified 10 products from 7.7 to 13.5 bands. The average level of bandsharing was approximately 0.57 ± 0.03 between 2 species.

<Fig. 1>. Common carp- and Israeli carp-specific RAPD patterns generated by 9 arbitrary primers. Each lane shows different individual DNA samples. Lanes 1, 3, 5, 7, 9, 11, 13, 15 and 18: common carp. Lanes 2, 4, 6, 8, 10, 12, 14, 16, 17 and 19: Israeli carp. m: Markers.

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