Editorial
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Development and Application of Molecular Markers: Past and Future

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Editorial

Biomarkers are regarded highly for their ability to discriminate between genotypes in fields of genetic science. The first molecules to differentiate between various plant types were secondary metabolites such as anthocyanin, phenolic etc. Nevertheless, their wide use was restricted by several factors including uncertainty and limited availability. For the short period prior to the development of more effective DNA markers, enzyme markers (allozymes and isozymes) gained significance but with the development of the powerful DNA markers that detect variation among individuals based on the polymorphism in their DNA they regained their status. Initial application of DNA marker technology began with the use of RFLP markers for the creation of the human genome's first molecular map [1]. DNA marker technology RAPDs have been commonly used concurrently in many loci for the screening of polymorphisms [2].

Other techniques which are used as molecular markers are Inter-simple sequence repeats (ISSRs; or PCR primed microsatellite; MPPCR) reproducibility benefits from using lengthy primers in PCR amplification in comparison to RAPD and the higher annealing temperature of PCR. As is the case with RAPDs, no previous target sequence information is required for ISSRs, and thus it can be applied with ease to non-model species [3]. AFLP analysis is attractive to establish associations by evaluating individuals of segregating populations through high reproductively, rapid development and high frequency of identifiable polymorphisms. Repetitive sequence based PCR is the genomic fingerprinting approach based on the use of primers of the PCR, originally developed for bacteria, of DNA that correspond to interspersed repetitive elements, including REP, ERIC and BOX. This cycle was also reproduced in longer periods in higher species of animals and plants. Some AFLP variants molecular marker used are Selective Amplification of Microsatellite Polymorphic Loci (SAMPL), Sequence-specific amplified polymorphism (S-SAP), Amplification of insertion mutagenized sites (AIMS), Methylation-sensitive amplified polymorphism (MSAP), Resistance gene analog anchored amplified fragment length polymorphism (AFLP-RGA), Three endonuclease AFLP (TE-AFLP), Secondary digest AFLP (SDAFLP), Microsatellite-AFLP (MFLP), Selectively amplified microsatellite (SAM) analysis, MuAFLP, MITE-AFLP, etc. [4]

Popular genotyping techniques which includes detecting locus specific single nucleotide polymorphisms (SNPs) are Allele-specific oligonucleotide (ASO) hybridization Includes Illumina's GoldenGate Vera-Code pool assay, Allele specific reverse dot blot hybridization, Oligonucleotide ligation assay (OLA), Single strand conformation polymorphism (SSCP), Dynamic allele specific hybridization (DASH), Amplification refractory mutation system (ARMS), Flap endonuclease (FEN) – Invader assay and Serial Invasive Signal Amplification Reaction (SISAR), Allele-specific PCR (AS PCR), Denaturing high-performance liquid chromatography (dHPLC), High resolution melting analysis (HRMA), Temperature gradient gel electrophoresis (TGGE), Complexity reduction of polymorphic sequences (CRoPS), sequences (CRoPS) AFLP, NGS, sequence alignment by Van Orsouw et al. Specific-locus amplified fragment sequencing (SLAF-seq), etc. The more recent molecular markers used in the biology are Gene anchored amplification polymorphism (GAAP), Sequence related amplified polymorphism (SRAP), Intron sequence amplified polymorphism (ISAP), Intron Polymorphism (IP), Target region amplified polymorphism (TRAP), Conserved region amplified polymorphism (CoRAP), Start Codon Targeted Polymorphism (SCoT) [4]. These are the most widely used molecular markers of different type in various biological research.

Molecular markers provided valuable tools for identifying alleles. Visible or measurable variations in phenotype are alleles with respect to classical genetics. In terms of molecular genetics, different DNA sequences are alleles, ultimately often creating phenotypical distinctions. Although the DNA alleles do not inherently cause phenotypic changes, they can be correlated with these phenomena. Earlier, DNA-based markers were the basis for cDNA-based markers, but now alternative approaches dominate the genetic improvement scenario essential for plants and animals. DNA sequencing technology recently made it possible to simultaneously scan multiple positions in several individuals. Such approaches provide the benefit of extracting specific information from a single genomic area that often contributes to the simultaneous creation of thousands of high-density connecting maps. In addition, next-generation sequencing enables further analyzes of expression so that expressed mutations, unusual transcripts and alternative splice variants can be identified. The so-called "DNAs Future Fingerprinting' [5] and molecular markers are likely to be expressed as highly sophisticated chip and microfluidics-based technologies like GBS, DAarT, RAD, automated SNP and SSR typing etc. under those circumstances worldwide work will keep shifting to high-performing genomic and transcriptomic methods.

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