MARKER ASSISTED SELECTION

DNA marker is a term used to refer to a specific DNA variation between individuals that has been associated with certain characteristic (e.g. milk yield). These DNA or the genetic variants are called alleles. These markers to be useful to geneticist these must be (1) heritable and (2) discernable to the researcher. As all organisms are subjected to mutation as a result of normal cellular operations or interaction with the environment leading to genetic variation (polymorphism).

At the level of DNA, types of genetic variation include base substitution commonly referred to as single nucleotide polymorphism, insertions and deletions of nucleotide sequences within a locus, inversion of a segment of a DNA within a locus etc. the DNA markers are classified into two categories.

Type I: markers associated with genes of known function.

Type II: markers those are associated with anonymous genomic segments (*Their function is not known*).

Examples of DNA markers

1. Mitochondrial DNA markers.
2. Microsatellites.
3. Restriction fragment length polymorphism.
4. Single nucleotide polymorphism.

1. Mitochondrial DNA markers:
   DNA sequence divergence in mitochondrial DNA accumulates more rapidly than that in nuclear DNA. So, there is faster mutation rate in DNA due to lack of repair mechanism during mutation. The non-coding region of D-loop in mitochondrial DNA gets maximum mutation due to relaxed selection pressure. The Cytochrome b gene of mitochondria is used for species identification.
2. Single nucleotide polymorphism:
   Single nucleotide polymorphism describes the polymorphism caused by point mutations that give rise to different alleles containing alternative bases at a given nucleotide position within a locus.
3. Microsatellites:
   These consist of multiple copies of tandemly repeated simple sequence repeats (SSRs) that range in size from 1 to 6 base pairs. Microsatellite DNA sequences are evenly distributed in genome. The variation in Microsatellite DNA in different individuals is based on microsatellite size differences due to variation in number of repeats. The rate of mutation in microsatellite DNA is 1 per 100 generations.
4. Restriction fragment length polymorphism (RFLP): restriction endonucleases are the enzymes isolated from bacteria that can cause the double strand breaks in the DNA in the specific site having a specific nucleotide sequence called restriction sites. When a DNA molecule is subjected to a restriction endonuclease it will cause the double strand breaks in the restriction sites present in the DNA and the pieces of the DNA generated by the restriction endonuclease are called restriction fragments. As the location of these restriction sites varies from one individual to another within a specie, the restriction fragments generated varies from one individual to another within a specie. This can be useful marker for selection of good individual animal for breeding purpose.