Importance of Genetic Diversity in the Population

Introduction

Importance of genetic diversity in the population was known to early breeders of plant and livestock species, even without much understanding its sound biological connotations. With advancement of science, genetic diversity is now considered as the primary evolutionary force required for all living organisms, which provides ability for adaptation under varying environments and for speciation. Genetic diversity arises from possession of certain alleles for some individuals, which are characteristically fit for a particular environment, with better chance of survival than others in the population and to produce progeny for their next generations [1].

Genetic diversity is responsible for creating variability among individuals within one species at the genetic level and gives rise to genetic variants available in the population. Some of the genetic information, available only in few selected plant and animal species, may be crucial for improvement of crop varieties and animal populations with suitable adaptive (e.g., disease and pest resistance) and productions traits (better growth and feed efficiency). This is more necessary with the worldwide climate change scenario [2,3]. Knowledge of genetic diversity will assist in choosing the right strategy for crop breeding and conservation programmes under changing environmental scenarios [4-6]. On the other hand, genetic diversity in the livestock species is essential to sustain production performance and to continue breeding objectives for genetic improvement [7]. Extensive knowledge about the status of genetic diversity, coupled with other population structure and breed characteristics are fundamental requirements for devising efficient management scheme for farm animal genetic resources, FAAnGR [8].

Measure of Genetic Diversity

Genetic diversity estimates provide understanding about the status of various evolutionary processes in the populations. This also helps us to infer population structure and diversity to devise breeding perspectives in the crop and livestock species. Therefore, knowledge of genetic diversity and its precise assessment is essential for making correct inferences about population structure [9].

A number of techniques based on morphological traits were developed and 'breed/strain descriptors' were generated for assessing genetic diversity of a population of crop and livestock in the past half century and [10,11], in spite of valuable contributions of such breed/strains descriptors in estimating genetic diversity of several crop and livestock populations through their phenotypes, they suffer from fundamental limitations of being an indirect method of measurement. Such estimates are often marred by environmental bias, since phenotype is influenced by both genetic variations and environmental factors.

In the present era of molecular biology and genomics involving high-density genotyping and sequencing technologies [12,13], assessing genetic diversity through the use of DNA markers becomes more effective. Using molecular data, both the components of genetic diversity (within and between populations) of crop and animal species can be evaluated directly at the genetic level in several ways through the estimation of different population genetic parameters, viz. genotypic and allelic frequency, proportion of polymorphic loci, the observed and expected heterozygosity and pattern of the alleles [14]. The introduction of massive sequencing platforms also heralded the genomic era in the field of molecular biology when complete genome of a number of crop and animal species are sequenced unraveling genetic architecture of a species and for genome wide association studies [15-21]. Therefore, the procedures based on direct assessment of genetic diversity are now increasingly utilized for plant and livestock breeding programmes worldwide.

Conclusion

Present global concerns are towards maintenance, sustainable use and conservation of biodiversity, in the backdrop of alarming rate of extinction of wild species of crops and animals from the earth. Therefore, halting further erosion of genetic diversity requires urgent and well-
planned interventions for survival of the vast biodiversity resources for each country [22]. Sustainability and continuation of these vast biodiversity will depend on the availability of genetic diversity in right proportion in the population. Numerous farming communities and Government agencies of almost all the countries have taken up various livestock and plants conservation efforts for last several decades. It is a continuous process to document the status of genetic diversity and identifying factors affecting this in the population in our own interests to continue plant and animal breeding in right perspective.

References


