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Short communications

BIODIVERSITY CONSERVATION AND CHARACTERIZATION OF PLANT GENETIC RESOURCES

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The significance of biodiversity conservation and the need for its sustainable and equitable use can not be overemphasized, particularly in a country like India, which is one of the top twelve megadiversity countries of the world. Conservation and related aspects of Plant Genetic Resources (PGRs) have been discussed widely in recent years including the discussions at the three meetings of a Keystone International Dialogue Series, which concluded in 1991, and the Biodiversity Conservation Treaty signed at Rio de Janeiro in June, 1992. It has been realized that the problem of biodiversity conservation is complex, particularly when much of this biodiversity is unknown. Better characterization of biodiversity, has also become possible with the advent to new techniques of molecular biology. These two aspects are briefly described in this communication.

Extent of loss of biodiversity and the measures to stop it

It is estimated that only about 1.5 million of a total of estimated 30-50 million species (including microbes and insects) have so far been described (given scientific names) and that roughly 5000 species are lost (become extinct) every year. Because of latitudinal species diversity gradient (LSDG), i.e. due to a decline in diversity from equator to the poles, and also due to decline of biodiversity in highly productive systems, the losses are most severe in tropical countries like India, where human population swells at an alarming rate, so that here it is a battle - "human *vs* animals and plants". It is, therefore, obvious that the biodiversity can not be maintained by taking one species at a time.

Alternative strategies are, therefore, being proposed and debated. One of the suggested alternatives is to identify and protect areas, that are not only rich in biodiversity, but also provide refuge for endangered species. These

areas will have to be protected from activities that cause species loss. Since there are limits to how much land can be set aside as reserves, the problem is not so simple. The problem gets further acute in view of recent evidence that areas rich for one group of animals may not be found in diversity hotspots (Prendergast *et al.*, 1993). The same trend may hold good for plant life also.

Biodiversity is generally described by two parameters : (i) alfa (α) diversity, giving an estimate of the number of species in a specified area, and (ii) beta (β) diversity, giving an estimate of the turnover of species across space. Although we have maps of certain continents showing α diversity, little is known about β diversity. For animals, it has been shown that α diversity peaks along gradient of productivity and decline in the most productive systems. However, for β diversity, the ranges of species distribution are not well understood. Its knowledge is necessary, because if the ranges of distribution of species are large, α diversity is independent of the area sampled and national parks or wild life reserves can be placed any where, but if ranges are small and diversity low, then many scattered reserves will be needed. Although very few such studies have been conducted in plants, wild life reserves need to cover huge area of land, if *in situ* biodiversity conservation has to be undertaken at any reasonable scale. The *ex situ* conservation efforts can not be used as a substitute because, much of our biodiversity is still not documented. The impact of necessary future efforts for *in situ* conservation have been assessed in some cases as shown below.

In USA, a 'Wild land Project' calls for establishment of 'wilderness reserves', 'human buffer zones' and 'wildlife corridors' throughout the areas of human habitation. This project estimates that atleast half of the continent may need to be set apart for biodiversity preservation. Similar estimates are being made elsewhere, even though these ideas sound impractical. Some specialists, therefore, accept that some of the biodiversity will have to go, and nothing can be done about it. (See comments on "7th Annual Meeting of the Society for Conservation Biology" held on June 11, 1993 - Science *260*:, p. 1868-25th June, 1993).

In view of the above and even otherwise, a proposal for debate among scientific community, envisages *ex situ* conservation by sampling and freezing the biodiversity as *"library of life"*, without studying it, so that the labour costs may be substantially reduced and the threatened species can be frozen for future use. This is necessary, because there is certainly a danger of losing much of the uncharacterized biodiversity, if we wait to study and characterize them before conservation (Benford, 1992). In this proposal, it is suggested that the freezing of living organisms on site can be done with ordinary ice/dry ice, to be later transferred to liquid nitrogen tanks. This job can be done by local labour, and the trained taxonomists, may study and classify the taxa, whenever possible.

Characterization of PGRs

In any effort for *in situ* or *ex situ* conservation of PGRs, their characterization is essential. This is traditionally achieved by a combination of morphological and agronomic traits. The effectiveness of this traditional approach is limited and the approach is sometimes also prohibitive. Therefore, the preparation of molecular genetic maps and DNA finger printing have proved to be valuable tools for characterization of breeding lines, crop varieties and other collections representing PGRs at national and international institutes. This is also necessary to ensure that the identity and genetic stability is not lost during conservation.

The molecular markers, that have been used for characterization of crop varieties and other plant genetic resources, include RFLPs, RAPDs, minisatellites (VNTRs) and microsatellites (SSRs). RFLPs are also being converted into sequence tagged sites (STSs) to facilitate their use by different workers at the global level. These molecular markers have also been used for map assisted selection in plant breeding programmes, and map based isolation of important genes.

Characterization of PGRs, as above, will also help (whenever required) in the protection of IPRs including plant breeders rights (PBRs) and farmers rights. There are differences in provisions for protection of these rights in the developed and developing countries, an aspect which is receiving attention both by the governments and by the scientific communities in different countries. In all situations, however, characterization of PGRs using molecular markers, will be inevitable in future.

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