Molecular diversity, molecular taxonomy and DNA fingerprinting

With some background knowledge on use of molecular marker techniques[1], my attention has been drawn to new initiatives being undertaken in India on molecular studies especially on systematics, DNA fingerprinting and genetic diversity. Several projects are currently studying biodiversity, particularly at molecular level. These studies are considered important for conserving and protecting our biological wealth. Enormous money is being spent on such initiatives (the new one being molecular systematics). However, the basic question is: Diversity is there; so what?

This is not a negative critique but rather to encourage and support thought into rationalizing our anxiety to use molecular techniques as a means to an end but not an end itself. Before I argue the case further, I shall briefly discuss the science behind biodiversity studies.

For studies in plant systematics, whether it is in the area of alpha taxonomy or evolutionary biology or any other area, the characters it chooses for analyses are presumed to have a genetic basis. Most molecular systematic studies probe for differences between macromolecules such as proteins, RNA and DNA, employing largely electrophoretic techniques.

However, any studies on biodiversity for conservation and protection of a particular species must study the genetics, ecology and evolution of that species. Research in the area of evolutionary ecology has proposed several observations that are critical for both interspecific and intraspecific variations. These include: (i) many species that are being compared, comprised of populations specialized to different interactions, need to be assessed for diversity in their adaptiveness[2] as well as their fitness, (ii) diversity under changing ecological conditions, (iii) maintenance of specific characters and/or genes in designated population[3], and (iv) diversity at hybrid zones, i.e. diversity of characters that are important for maintaining the structure and those vital for evolution[4]. Undoubtedly genetic diversity measurements are important for considering conservation of particular species. A decline in genetic variation can undermine the ability of an organism to respond to natural selection and consequently limit its evolutionary potential. Small populations are often subject to the loss of alleles through genetic drift, or random fluctuations in allele frequency. Thus any study on genetic diversity has to address the above issues.

Balakrishna discusses the rationale behind using genetic diversity data in crop plants for their improvement. For example, while considering genetic variety in cereals or millets from a given ecosystem or collection, we are bound to find enough variability in the germplasm that can be considered sufficient to designate the germplasm into varieties. Characters like variability in rice germplasm to salinity or drought stress, variability in millets to their nutrient content further support the above contention. Although Jarne and Lagoda[5] give a detailed account on the use of markers like microsatellites in diversity studies, it has been clearly established that marker sets like microsatellites are poor markers to arrive at phylogenetic inferences, not to mention their high operational costs. Thus, use of such techniques to merely reconfirm that germplasms are different does not by itself answer any of the above discussed questions on genetics, ecology, evolution and conservation.

Several of our scientific agencies are taking interest in molecular diversity, systematics, taxonomy, since India is a signatory to the Convention on Biological Diversity (CBD) and to the WTO as well. This situation warrants urgent steps to look at both policy and science of the issues covered by CBD and the WTO.

As a resource person attending the CBD issues and familiar with the WTO concepts, I have the following remarks to make. Articles 7, 8, 15, 16, 18, 19 and 20 of the CBD all encompass the spirit of CBD, i.e. conservation, sustainable use and equitable sharing of benefits or resources of biological diversity. Similarly, Articles 20 and 23 of the TRIPs–GATT negotiations request signatories to conform to the TRIPs provisions and also state that any of such provisions that are detrimental to the biodiversity of a country may be overlooked.

Having attended the Fourth Conference of Parties to the CBD at Bratislava (4–15 May 1998), it is quite evident that global efforts will increasingly focus towards systematics, and this is the reason for a major international programme, the Global Taxonomy Initiative, funded by the Global Environmental Facility (GEF), which will start soon.

The growing fear of several countries on establishing claims of their biodiversity led many scientists embark on initiatives aimed at recording their biological wealth. This was done in different ways; one of these being inventories of taxa to molecular sequence databases. But in order to justify the investments into these activities, the following questions need to be addressed: (i) What is biological wealth? (ii) What means do we use for establishing the claims? (iii) How practical is it to ascertain the molecular variations of a given species? (iv) What is the significance of these variations? (v) How do we propose to use the data to protect our interests? (vi) How sustainable will these activities be? Thus all these questions have to be kept in mind before suggesting or approving of any programmes.

As discussed earlier in the article, mere identification of variations using probes will mean too little if the diversity is not to be used. If we want to resolve several ambiguities in conservation, the completely neglected areas like systematics, reproductive biology, conservation genetics, and evolutionary biology need to be given a fresh lease of life. It is therefore important for our scientists to be made aware of policy issues and application of these techniques in an useful and meaningful manner before rationalizing activities which will merely compound data generation without it being used. Jumping onto the bandwagon of popular euphemisms like genetic diversity for protection against Intellectual Property Rights (IPR), for assessing phylogenesis in crop plants – especially in highly researched groups like cereals,

millets – will only accumulate data without any use or purpose.

Thus, I can safely state that spending enormous monies into such fashionable areas like molecular systematics of crop plants, genetic diversity studies for protecting our diversity will only go down the drain if we do not use the generated data effectively.

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PM's statement in Parliament spells out stand on CTBT and FMCT: Extended range *Agni* being developed

On 15 December 1998 while making a statement in Parliament on bilateral talks with the United States, Prime Minister A. B. Vajpayee took the opportunity 'to reiterate that India's commitment to global nuclear disarmament remains undiluted. As Hon'ble Members are no doubt aware, India has consistently maintained that a nuclear-weapon-free-world would enhance not only our security but the security of all nations. That is why numerous initiatives in this direction were taken during the last fifty years; such steps as would encourage decisive and irreversible measures for the attainment of this objective. Regrettably, the international community, particularly countries that have based their security on nuclear weapons or a nuclear umbrella, have been reluctant to embrace this objective. Keeping open our nuclear option, therefore, became a national security imperative three decades ago, an imperative equally valid for India in the post-Cold War period. The option that was exercised in May 1998 was thus a continuation of a decision taken near 25 years earlier; during which period India had demonstrated an exemplary nuclear restraint, given the exceptional security-related complexities of our region. I wish to place on record that successive governments continued to safeguard this option, demonstrate our capability and take such steps as were necessary to ensure the viability of the option through weaponization.

Just as our conventional defense capability has been deployed in order to safeguard the territorial integrity and sovereignty of India against any use or threat of use of force, the adoption of our nuclear deterrent posture has also followed the same logic. We have announced our intention to maintain a minimum nuclear deterrent, but one that is credible. Mindful of our global and enhanced responsibility to address concerns of the international community, and in order to re-assure all countries about the defensive nature of our nuclear capability, we have engaged in bilateral discussions with key interlocutors. In international fora, like the United Nations, India is the only country possessing nuclear weapons to raise a call for negotiating a gradual and progressive elimination of all nuclear weapons, within a time-bound framework. . .'.

In his statement Vajpayee revealed that, after six rounds, the range of talks between India and the United States has become focused. On the Comprehensive Test Ban Treaty (CTBT), the PM spelt out India's position thus:

'India remains committed to converting our voluntary moratorium into a *de-jure* obligation. In response to the desire of the international community, as expressed to us in our bilateral and multilateral interactions, that the Treaty should come into effect in September 1999, in my address to the United Nations General Assembly on 24 September, I reiterated broadly what I had said in Parliament, that: "India is now engaged in discussions with our key interlocutors on a range of issues, including the CTBT. We are prepared to bring these discussions to a successful conclusion, so that the entry into force of the CTBT is not delayed beyond September 1999. We expect that other countries, as indicated in Article XIV of the CTBT, will adhere to this Treaty without conditions".

'. . . This stand does not come in the way of our taking such steps as may be found necessary in future to safeguard our national security. It also does not constrain us from continuing with our R&D programmes, nor does it jeopardize in any manner the safety and effectiveness of our nuclear deterrent in the years to come.'

On the proposed Fissile Material Cut-off Treaty (FMCT) the PM anchored India to the following position:

'We have expressed our willingness to join the FMCT negotiations in the Conference on Disarmament at Geneva. It is our understanding, as that of many other countries, who have confirmed this to us, that the objective of these negotiations is to arrive at a non-discriminatory treaty, that will end the future production of fissile material for weapons purposes, in accordance with the 1993 consensus resolution of the UN General Assembly. We are willing to work for the early conclusion of such a treaty.

'It was suggested to us that we might examine announcing a moratorium on fissile material production. We have conveyed that it is not possible to take such steps at this stage. We will, of