Biological Diversity Act, 2002: threat to agricultural production and food security!

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The year 2008 witnessed the lowest food grain stocks in the last three decades and the world had consumed more food than it produced. The Indian economy has been growing rapidly at an impressive annual rate of about 8.5% over the last few years, yet India is the home for 20% of the chronically hungry of the world and 24% of its population is undernourished[1]. This is mainly attributable to the slow pace of growth of the agricultural sector (2.5%) in the past decade, besides the disparity in access to the resources. The ecologic and economic distress in the farming sector, manifested as the continuing national tragedy of farmers' suicides[2] and the large scale import of food grains after three decades of food self-sufficiency at prices higher than that of the internal market[3,4], are pointing to an impending, yet avoidable food crisis. Food security is an essential pre-requisite for national security and sovereignty. India, heading towards the status of the most populated country in the world by 2050 (ref. 5), is left with only 2.5% of the global land area and 7.8% of the biodiversity to produce food for 18% of the world population. Wise management of land, water and biodiversity is the key to achieve sustainable food security. Among these three pillars of food security, land and water are limited and the least amenable for augmentation. But the biodiversity component, being truly renewable, offers unlimited opportunities to enrich the food production as its use in a given system does not affect its availability elsewhere. Our challenge of feeding the ever-increasing population in the midst of the climate chaos can only be addressed by drawing heavily from the global plant genetic estate.

No country ever possessed all the genetic resources essential for its existence. Every country in the world uses exotic genetic material to enhance the productivity of its crops and livestock, as the genetic limits of the native stock can be overcome only by incorporating genes from exotic genetic material. The Food and Agriculture Organization's 22nd Conference adopted a resolution[6] (Resolution 8/83) that plant genetic resources are a heritage of mankind to be preserved and to be freely available for use, for the benefit of the present and future generations. Developing countries *en masse* pushed through and adopted the resolution, while Canada, France, Germany, Japan, United Kingdom and the United States of America officially reserved their position with respect to the FAO undertaking as it explicitly specifies that the term plant genetic resources also includes newly developed varieties and special genetic stocks. Europe in the 1960s and USA in 1970, through legislation, had established breeder's ownership rights for the sake of the highly developed seed industry. The developing countries' effort to keep all types of breeding material within the public domain, outside the scope of patents, was at variance with the demand of the developed countries to provide and respect intellectual property protection and this led to the 'FAO gene wars'[7]. In 1989, developed countries succeeded in establishing Plant Breeder's Rights as provided under UPOV (International Union for the Protection of New Varieties of Plants). This FAO resolution[8], though recognizes Farmers' Rights, sets the stage for the showdown between the North and South over genetic resources in the United Nations Convention on Biodiversity (CBD)[9].

The biodiversity-rich developing nations had high expectations for CBD under the premise that biological resources, being the raw material for the biotechnology industry, is the key to potential economic success in the future. The high tide of publicity and hope in the popular and scientific media portrayed biodiversity as the most commercially important natural resource like oil or gold. The politicians and policy makers in the developing world were carried away by the wave of propaganda and lobbying by activists and NGOs, rather than empirical evidence. The South abandoned the common heritage strategy adopted in the FAO and successfully demanded national sovereign rights over genetic resources in the CBD negotiations. They also pushed for and succeeded in including equitable sharing of genetic resources in the CBD. The historic shift in position of the South that led to the tragic loss of biodiversity from the common heritage of humanity was chronicled by Kloppenberg and Kleinman[10] and Rosendal[11,12].

The demand of the southern nations for national sovereign rights over their biological resources was evidently based on the premise that they are rich, self-sufficient and have surplus genetic resources of high commercial value. Articles 3 and 15 of the CBD recognize sovereign rights of nation states over their biological resources and their authority to determine access to genetic resources through national legislation. Several countries, including India, have developed legal regimes and implementing mechanisms to regulate access to genetic resources[13]. Biological Diversity Act[14] of India is based on the above provisions of the CBD and the Sections 3 and 21 of the Act completely prohibit rest of the world from accessing biological resources occurring in India or knowledge associated with it without previous approval and equitable sharing of benefits arising out of the commercial utilization[15,16].

Purpose and rationale of this legislation was made clear by Raja, the then Minister for Environment and Forests, Government of India: 'The access (to India's biological resources) has to be on mutually agreed terms which inter-alia would include recognition of associated Traditional Knowledge of indigenous communities and equitable benefit sharing arrangements ... to deal with extensive pressure on our biological resources because of recent biotechnological developments ... India being a mega diversity country, should and would like to derive its strength from its rich genetic diversity ...'. We are now into the fifth year of implementation of the Biological Diversity Act and Rules and it is high time to critically analyse and take stock of the underlying rationale, hopes, promises and achievements of the Act.

A major snag of the CBD and the resultant Biological Diversity Act is a shift in focus from the ecological and scien-

tific value of biodiversity to its mere commercial value. It is true that the biodiversity is invaluable from every point of view. But the lion's share of it does not have any direct commercial value and diversity per se does not add value. Direct dependence of man on biodiversity is limited to economically important plants and animals. Out of the 250,000 species of flowering plants, only about 150 (0.06%) have been extensively cultivated and introduced into commerce and a mere 20 species supply over 90% of human diet. Just four species – wheat, rice, corn and potato – account for over 60% of the world's food supply[17].

The southern strategy of nationalization of biological resources in Rio in 1992 was aimed at countering uncontrolled corporate patenting and control of genetic resources besides equitable sharing of commercial benefits arising out of its use in the biotechnology, pharmaceutical and seed industries. Biotechnology has now matured into a discipline of its own and much of the euphoria and apprehensions have given way to realism. Total dependence of the biotechnology industry on the genetic resources of the third world is not true. The genes used for making insect-resistant crops are from the bacterium *Bacillus thuringiensis* which occurs widely over the world, was originally described from Thuringia in Germany. Similarly most of the genes used for developing herbicide-resistant crops are also not exclusively from the third world[18]. Natural products research, despite being important in the discovery of leads for the development of new drugs[19,20], have been de-emphasized by the pharmaceutical industry in favour of a synthetic chemical approach due to both scientific and commercial considerations[21]. The role of traditional knowledge in pharmaceutical discovery too has been relatively small in recent decades[21] and income from biodiversity prospecting for pharmaceutical products could be modest[22,23]. Mistrust, misunderstanding and stringent regulations in the South is leading to increased interest in bioprospecting in the North, mostly based on microorganisms and marine forms rather than plants[21]. Most multinational seed corporations together deal with no more than nine species and are self-sufficient with breeding material for most of these commercial crops[21,24]. Needless to say, the Indian fear of 'extensive pressure on our biological resources because of recent biotechnological developments' is naïve and baseless.

The high hopes and promises of equitable sharing of benefits arising out of the commercial use of traditional knowledge associated with biodiversity is turning out to be unrealistic[21,24]. The much trumpeted TBGRI model[25,26] from India, hailed as the first ever example of benefit sharing with an indigenous community has turned out to be a damp squib[27,28]. Costa Rica's National Biodiversity Institute (INBio), started in 1989, is the pioneer organization that developed the concept and practice of bioprospecting and benefit sharing[29]. INBio's commercial agreement with the pharmaceutical giant Merck, a well-known practical example for benefit sharing, has generated substantial direct payments[24] and 27 patents but no product has reached the market and no royalties have been paid to the providers of biodiversity[21,30]. A five-year agreement between the South African National Biodiversity Institute and the Chicago based Ball Horticulture, which is the first North–South bioprospecting agreement in the horticulture sector, led to the development of three commercial varieties. However, the royalties, despite being substantial, did not surpass costs of the project[21]. The experience of the National Biodiversity Authority of India (NBA) is yet another stark example. The NBA, whose main objective is equitable sharing of benefits, even after several years of its establishment, is neither known to have delivered any benefit to the stakeholders of biodiversity in the country nor have contributed to the conservation of biodiversity.

The argument for national sovereign rights over genetic resources has its roots in sheer ignorance of the world's interdependence on genetic resources and the evolutionary history of crop plants. Cultivated plants originated in different regions of the globe. The Russian botanist N. I. Vavilov has pointed out that certain areas of the world exhibit high degree of diversity of wild relatives and intraspecific variability. He regarded such centres of high genetic diversity as centres of origin of crop plants. Kloppenberg and Kleinmann[10] selected 20 food crops and 20 industrial crops that lead global production and estimated the magnitude of regional contributions and debts of geopolitical regions to global plant genetic estate. They proved that there is no such thing as genetic independence, instead nations of the world are linked in a complex network of plant genetic interdependence. No region can afford to isolate itself, or to be isolated, from access to plant germplasm in other regions of diversity, in spite of the variation in regional relationships. The general global rule is extreme dependence on imported genetic materials. Australia and North America, two principal bread baskets of the world that contribute enormously towards global food security, are almost totally dependent on exotic germplasm for food production. The food production of India (Hindustanean Region of Vavilov) depends on plant genetic materials derived from other regions for 48.6% of its food production. Indeed in the case of industrial crops, India's dependence on exotic plant genetic material is extremely high (92.7%). In fact, this is an underestimation of India's dependence on exotic genetic material for food production, as Kloppenberg and Kleinmann considered India as one of the megadiversity regions of rice and hence not dependent on other regions for genetic material of rice. But our rice breeding programmes are heavily dependent on the exotic germplasm of *japonica* rice varieties. The green revolution started with the cultivation of dwarf *japonica* rice varieties which later led to the development of a large series of rice varieties derived by cross breeding high yielding short duration dwarf exotic varieties with the poor yielding long duration tall indigenous varieties. India derives 35.26% of her food energy from rice[31] and 60% of rice[32] varieties released in India have exotic progenitors. Hence, the dependence of the nation on exotic genetic material for food production can be assumed to be up to 68%.

It is clear that the idea of national genetic independence is frivolous and its effects on agricultural production in the country will be disastrous and chilling. In fact, all revolutions – green, white and blue – those salvaged India from starvation and hunger, and led us to the safety of self-sufficiency and food security would have been impossible without exotic biological material. Indian farmers cultivate a large number of exotic crops and even today continue to introduce and domesticate foreign plants and animals for commercial utilization. Reliance of agricultural production on temporal diversity is increasing as crop varieties need to be changed more frequently to

maintain productivity against the odds of biotic and abiotic stress. India's dependence on external genetic resources is bound to increase drastically in future, especially in the wake of climate change. Due to the great diversity of agroclimatic regions, any plant or animal from anywhere in the world can be introduced into India and domesticated. We may have to introduce and cultivate crops like teff (*Poa abyssinica* Juss. – a staple food of east Africa) to mitigate vagaries of nature in a changed climate and further extend the cropped area to meet the increasing demand for food. Biological control of invasive weeds and insect pests is another area where introduction and utilization of exotic species becomes inevitable. The necessity of exchange of genetic resources and international cooperation are further exemplified by the global efforts to contain crop pandemics like the deadly Ug99 strain of wheat rust[33], to which the Indian Agricultural Research Institute is also collaborating.

National Agricultural Research Organizations under the Indian Council of Agricultural Research and the State Agricultural Universities procure and maintain exotic species and varieties of commercial importance as most of the plant and animal breeding programmes are entirely dependent on exotic germplasm as regular genetic transfusion is inevitable to maintain productivity and mitigate eventualities like pest and disease epidemics. With the introduction of the Biological Diversity Act, that curtails availability of genetic material from India to the rest of the world, we have sent an unsolicited invitation for 'equal and opposite reaction' and shut ourselves down behind walls that limit our own development, besides completely losing the moral authority to use exotic biological materials without the formal permission and benefit sharing with the respective countries of origin (imagine a situation where farmers in Kerala pay royalty to Brazil for every sheet of rubber or the farmers in Karnataka paying Mexico for each litre of sunflower oil produced!).

The provisions of the CBD recognize that the sovereign rights of nation states over their genetic resources, thrust upon humanity at the naïve insistence of India, and other developing countries undermine the role of sharing and distribution of genetic resources among human societies in supporting food production throughout the world. Nationalization of biodiversity to counter corporate patenting is akin to setting the home on fire to kill the rat. Restrictions on access and sharing of genetic resources across national boundaries will retard crop improvement programmes. Loss of biodiversity from the common heritage of mankind to the bureaucratic ownership of nation states will have adverse, unexpected impact on global food production. Even small countries like Bhutan and Sri Lanka[34], with extremely limited native diversity of crop plants, have erected iron curtains around their 'national biological wealth' to prevent 'biopiracy'. National legislations like India's Biological Diversity Act and the equally irrational Philippine executive order 247 (ref. 35) effectively shut down national boundaries against free access and sharing of germplasm of crop plants. Parochial restrictive measures on genetic resources are gradually becoming ubiquitous all over the world. Disputes over genetic resources, as in the case of basmati rice between India and Pakistan[36], could be yet another source of conflict between nation states.

India's position on CBD in Rio de Janeiro in 1992 was based on little scientific input and has now turned out to be counter-productive and self-defeating. As India (every other country too) heavily depends on global biodiversity for sustenance, we should ideally have argued for open access and free exchange of genetic resources in Rio de Janeiro. But the fatal lure for benefit sharing blinkered us to overlook the precarious state of food security in the country. It is high time we realize that the commercial benefits that can be derived through sharing of the biodiversity and the associated traditional knowledge is insignificant and irrelevant compared to vital issues such as food security and sustenance. Benefit sharing, professed as a shortcut to economic development, can neither be a substitute for innovation, invention or industrialization nor a sustainable source of supplementary income for the rural communities. Without adequate infrastructure and higher levels of scientific collaboration, it would only relegate the local communities to the status of 'fodder collectors' for the industry. The developing countries are left with only limited choices. Either, they have to live with the proprietary seeds of MNCs, or denounce plant breeder's rights and patenting of crop varieties. The former option with active support for a decentralized native seed industry and public research appears to be the only pragmatic and viable alternative in the current neoliberal scenario. Legal follies like the Biological Diversity Act will boomerang the Third World countries, some of which have already suffered bouts of food riots[37], and drive them to the brink. India is bound to be one of the first victims of nationalization of biodiversity, unleashed by ourselves and other developing countries. The historic treatment of biological resources as a common heritage has enormously benefited human societies across the globe. It has been shown that as a result of germplasm exchanges through the network of the Consultative Group on International Agricultural Research (CGIAR), countries have gained much more than their individual contribution through access to a wide variety of invaluable material from all over the world[32]. Spread of cash crops across boundaries must have created trade rivalries among nations, but the reduction in profit to any country is well compensated by introduction and domestication of many other crops from the global plant genetic estate. Attempts to implement a system of royalties for use of germplasm of each crop plant through multinational agreements as suggested by Pachico[38] would only heighten the mistrust among nations and lead to chaos. Despite being associated with geopolitical entities historically, genetic resources should be treated as a common heritage in the best interest of humanity[39]. The International Treaty on Plant Genetic Resources for Food and Agriculture (3 November 2001; ref. 40), adopted after seven years of negotiations at the FAO, marks a long-step forward in this direction. Many of the core issues remain unresolved, yet the treaty facilitates access and sharing of germplasm of important food and fodder crops, and underscores the societal need to leave biological resources in the public domain. As pointed out earlier, unlike oil, coal or timber genetic resources are truly renewable and use in a given system does not affect their availability elsewhere. Man carried his pets, livestock and crops all through his voyages, migrations and invasions to facilitate his existence in every niche that he carved out for himself. As human biology is no way determined by the political boundaries of nation states, tags of nationality cannot be attached to his

plants or animals or the genetic diversity that he has been conserving over generations. They are bound to be distributed across political boundaries just as ideas in politics, literature or science. Hence, we suggest that India should take the lead in the Conference of Parties (CoP) of the CBD to correct the historic aberration of nationalization and consequent parochial restrictions on open access and free exchange of the life supporting heritage of mankind. The Biological Diversity Act, hailed as 'an act for the new millennium'[41], should be amended before it takes its toll on the nation, to concentrate on scientific conservation of biodiversity and traditional knowledge associated with it.

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