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Biodiversity, Bio-prospecting, Intellectual Property Rights, Conservation and Sustainable Development – An Indian Experiment

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Abstract

Biodiversity is the degree of variation of life. It is a measure of the variety of organisms present in different ecosystems. This can refer to genetic variation, ecosystem variation, or species variation (number of species) within an area, biome, or planet. Terrestrial biodiversity tends to be highest near the equator, which seems to be the result of the warm climate and high primary productivity. Biodiversity is not distributed evenly on Earth. It is the richest in the tropics. Marine biodiversity tends to be highest along coasts in the Western Pacific, where sea surface temperature is highest and in the mid-latitudinal band in all oceans. There are latitudinal gradients in species diversity. Biodiversity generally tends to cluster in hotspots, and has been increasing through time but will be likely to slow in the future. The prospects of exploring biodiversity for new medicines, foods, crops, insecticides, pesticides and other commercially valuable genetic and biological products and processes are booming, thanks to the rapid development in biotechnology - particularly genomics, proteomics, metabolomics, enzymatic and transgenic technologies – Herbal Technology and Information Technology. This exploration of biodiversity for commercially valuable genetic and biochemical resources is termed as "bioprospecting". Nowadays ABS issues have become a central theme for subsequent detailed discussions and decision making under CBD, TRIPS and the WIPO. It is therefore increasingly urgent for the CBD to make ABS work as was intended. The entry into force of the Nagoya Protocol represents a step in this direction. In India, we can be proud of having the distinction of the first country in experimenting a benefit-sharing model that implemented in Letter and Spirit Article 8(j) of CBD.

Keywords: Biodiversity, Bioprospecting, Intellectual Property Rights, Kani Model, Benefit Sharing

1. Introduction

Humankind has been prospecting biodiversity from the very dawn of civilization. Modified use of bioresources for food, medicine and other material requirements had been the traditional form of bioprospecting. Modern prospecting involves well-organized research and methodologies. Man depended entirely on nature's bounties to fulfil all his demands, physical, material, aesthetic and spiritual. This close dependence on natural resources for survival enabled him to live in harmony with nature, making use of the resources just to meet his immediate requirements. The close interaction of man with nature and his environ helped him to amass a huge wealth of knowledge which has come down to the present generation through

oral traditions and written documents. This knowledge system is presently known as traditional knowledge. Traditional knowledge is a dynamic knowledge system ever-changing, adapting, expanding and adjusting to the local situations and it has close links with the culture, civilization and religious practices of the communities. It covers all spheres of human activity such as art, architecture, agriculture, literature, education, environment and all other human vocations.

Genetic resources constitute an integral component of biological diversity. They provide the basis not only for the continuous evolution and maintenance of the life – supporting systems on earth, but also for the sustainable economic, scientific, technological, cultural and spiritual development of humankind. There is a growing body of information on the significant contributions that genetic resources and associated traditional knowledge make to global economy and global intellectual property regimes. The prospects of exploring biodiversity for new medicines, foods, crops, insecticides, pesticides and other commercially valuable genetic and biological products and processes are booming, thanks to the rapid development in Biotechnology - particularly genomics, proteomics, enzymatic and transgenic technologies – Herbal Technology and Information Technology. And, this exploration of biodiversity for commercially valuable genetic and biochemical resources is termed as "bioprospecting" - a concept pioneered by Thomas T. Eisner as "Chemical prospecting" (Eisner 1989, Reid *et al.* 1993). The advancements in biotechnologies have further redefined the overall scope and utility of bioprospecting to encompass all relevant activities related to systematic search for genes, natural compounds, designs and whole organisms in wildlife with a potential for product development by biological observations and biophysical, biochemical and genetic methods without disruption to nature (Mateo et al. 2001). In short, bioprospecting involves investigation of genetic resources or biochemicals for new commercial leads (Laird and ten Kate 2002) and includes three major areas such as "chemical prospecting", "gene prospecting" and "bionic prospecting" (Maeto *et al*. 2001).

India is one among the 12 mega gene centers of the world. The Indian Gene Centre (Vavilovian 'Hindustani' Centre) is considered the centre of origin and domestication of as many as 356 major and minor crop plant species and as many 326 wild relatives of crop plants. India has always been playing a proactive role in the development and implementation of several global, international, regional and national policies and programs related to environment, biodiversity, trade, intellectual property rights and other relevant areas. Biodiversity and associated traditional knowledge are two capital resources of India, and they form the prime focus of all the sectoral and cross-sectoral programs centered on sustainable development.

Throughout history, biodiversity has been the commons of local communities, with both resources and knowledge being freely exchanged. The concept of sovereign rights or property rights in genetic resources was almost alien to the traditional communities. Less than a year after CBD came in to force, the World Trade Organization (WTO) in 1994 was established with a different agenda. The convention is founded on the principle that local communities are dependent on biodiversity and should continue to benefit from it. The WTO administers a global trading system, much of which is founded on the private monopoly rights of transnational corporations over biodiversity. Thus we observe a paradigm shift in the world view on biodiversity and its utilization in the 21st century.

2. Traditional knowledge

Traditional Knowledge (TK) is a community based system of knowledge that has been developed, preserved and maintained over generations by the local and indigenous communities through their continuous interactions, observations and experimentations with their surrounding environment (Pushpangadan and Nair, 2005). It is unique to a given culture or society and is developed as a result of the co-evolution and co-existance of both the indigenous cultures and their traditional practices of resource use and ecosystem management. The accumulated wisdom, knowledge belief and practices embodied in the TK system were handed down to generation by an unbroken tradition and culture. The medical wisdom of such traditional communities are the target of drug hunters as an effective short cut for locating new and useful compounds of great pharmaceutical value. It is now well known that the possibility of finding a potential bioactive compound through random screening of plant samples is 1 in 10,000 and that of hitting a marketable drug 1 to 4 of such potential hits. In contrast, the success rate of finding bioactive compounds through selective screening based on traditional knowledge is 1 in 100 and that the discovery of a marketable drug is 1 in 2. Many plant derived drugs employed in modern medicine were first discovered through ethnopharmacological investigations.

The traditional knowledge associated with the biodiversity which is developed and held within the indigenous and local communities are thus found to be the most valuable lead for modern technological innovations and in developing novel food (functional food, medicinal food, and nutraceuticals) medicines (drugs and pharmaceuticals) phytochemicals and other products of commercial importance. Biodiversity and TK are thus the most powerful resources which with the interventions of science and technology can generate wealth with the advent of new tools and technique, particularly biotechnology could convert biodiversity resources into industrially and commercially valuable products and processes having increased productivity and application in many crucial areas such as agriculture (including aquaculture) healthcare, medicines, vaccines, diagnostics, gene(s)- genetheraputics, environmental protection and bio-energy etc.

3. All India Co-ordinated Research Project on Ethnobiology (AICRPE), 1982 – 1998

The Indian Council of Agricultural Research convened a meeting of its inter-organizational panel for food and agriculture on September 21, 1976 under the Chairmanship of Prof. M.S. Swaminathan, the then Director General, ICAR. Prof. Swaminathan felt the urgent need to undertake an ethnobiological study of the tribal's of the country to tap and document the fast disappearing life style, knowledge system and wisdom of these people. This panel decided to form a team of experts to examine the current status of ethnobiological studies of the tribal areas and to submit a report as to how the biological resources found in these communes could be conserved and utilized for socio-economic improvement of tribals on one hand and country on the other. Dr. T N Khoshoo along with Dr. E K Janaki Ammal prepared the AICRPE project proposal which was considered by the high level committee of Science and Technology, Govt. of India. Department of Science and Technology (DST) formally launched the project in July 1982 under the Man and Biosphere Programme (MAB) of UNESCO. When the Ministry of Environment and Forest (MoEF) came in to being the MAB programme along with AICRPE was transferred to MoEF. In September 1983, MoEF set up a co-ordination

unit at RRL, Jammu (now known as Indian Institute of Integrative Medicine, IIIM-CSIR) with Dr. P. Pushpangadan as the Chief Co-ordinator of this project for overall supervion, co-ordination and implementation of various programmes included in the AICRPE.

From the deliberations it emerged that the biological resources in the tribal and other backward areas were affected due to the indiscriminate and unplanned management. Initially the focus was given on the botanical aspect and the zoological part was completely neglected. But later the incorporation of the zoological aspect became inevitable as the tribal's use a big range of animal products. Ethnobiology brings together diverse disciplines like botany, zoology, anthropology, linguistics, sociology, archeology and others. Of late, with the renewed interest in traditional medicine, ethnobiology is gaining prime importance.

This multi-institutional and multi-disciplinary project was operated in about 27 centres by over 500 scientific personnel located in the different institutions spread over the length and breadth of the country. AICRPE during the course of its operation (1982-1998) recorded information on the multidimensional perspectives of the life, culture, tradition and knowledge system associated with biotic and abiotic resources of the 550 tribal communities comprising over 83.3 million people belonging to the diverse ethnic group. In India there are 550 communities of 227 ethnic groups. There are 116 different dialects of 227 subsidiary dialects spoken by tribals of India. The knowledge of these communities on the use of wild plants for food, medicine and for meeting many other material requirements are now considered to be potential information for appropriate S&T intervention for developing value added commercially marketable products. The Traditional Knowledge (TK) is oral in character and not qualified for the formal IPR system. The vast information collected by the AICRPE team is locked up as unattended reports for want of proper resources. Traditional knowledge on about 10,000 plants (Figure 1) have been collected during the course of the project. It may be mentioned here that the classical systems of medicine (Ayurved, Siddha, Unani, Amchi etc.) makes use of only 2500 plants where as we have a database on 10,000 plants which requires further scientific validation. Out of this 8000 wild plant species used by the tribals for medicinal purposes, about 950 are found to be new claims and worthy of scientific scrutiny. 3900 or more wild plant species are used as edible subsidiary food /vegetable by tribals. About 8000 are new information's and at least 250 of them are worthy of investigation. Out of the 400 plant species used as fodder, 100 are worthy of recommending for wider use and out of 300 wild species used by tribals as piscides or pesticides, atleast 175 are quite promising to be developed as safe pesticides (Pushpangadan, 1995)

4. Intellectual property rights (IPRs)

The term 'intellectual property' is loosely defined as a 'Product of the mind'. According to World Intellectual Property Organisation, one of the specialized agencies of the U.N system provided that 'Intellectual Property', shall include rights related to:

i. literary, artistic and scientific work.
ii. performance of performing artist, phonograms and broadcasts.
iii. invention in all fields of human endeavour.
iv. scientific discoveries.
v. industrial design.

vi. trademarks, service marks and commercial names and designations.

vii. Protection against unfair competition and all other rights resulting from intellectual activities in the industrial, scientific, literary or artistic fields.

Intellectual Property is a category of public law that generally includes Patents, Copyrights, Trademarks, Geographical indications, Industrial designs, Utility models, Plant breeders rights, Integrated circuits rights and Trade – secrets. A *sui generis* regime for databases has also been established in some countries.

IPRs emerged strongly during the industrial revolution and it has been an important driving force behind rapid industrial growth and prosperity of the western countries during the last 3 centuries. IPRs of 18th and 19th centuries were primarily to protect engineering or chemical innovations wherein identification of the novelty, the inventive step and innovator is easy. Recent worldwide extension of the IPRs in the field of biology has however attracted much controversy. The IPR regime from the very beginning has not given any importance and totally neglected informal knowledge of the people. It was not even considered worth acknowledging. In many cases the informal knowledge of traditional communities which directly or indirectly contributed to several inventions or patentable products, was never acknowledged. The profit accrued from commercialization of such products was never shared with the traditional communities. The traditional communities in many parts of the world were voicing against this exploitation. In the first International Congress of Ethnobiology held in Belem (Brazil) in 1987, leaders of indigenous communities mainly from Latin America, many environmentalists, scientists and activists for the first time seriously discussed this issue and resolved to come out with a declaration known as 'Declaration of Belem". This declaration recognized a basic obligation that "procedures be developed to compensate native people for the utilization of their knowledge and their biological resources". The second congress of the international society held at Kunming, China in 1990 in which the senior author was elected the Treasurer of this International Society, resolved to establish a global action plan, 'the Kunming Action Plan', calling for specific and urgent action to stop destruction of biological and cultural diversity as mandated in the declaration of Belem. This meeting also gave shape to the establishment of the Global Coalition for Bio-Cultural Diversity to unite the indigenous people, scientists and environmentalists concerned with the protection of indigenous/local people's rights. The presence of this society's powerful spokesmen at Rio-de-Janeiro in 1992 during the Earth Summit was mainly responsible for the incorporation of Article 8(j) and Article 10(c) in CBD to ensure legal protection for traditional/local community rights (George V. et al., 2013).

The oldest record of granting such a monopolistic right to an individual for a new innovation was in Greek. The Greek emperor in 700 BC granted one year monopoly right to the royal cook who prepared a delicious dish using the spices particularly Ginger imported from the western coast of India, Kerala. It was something like a patent right. But the patent rights as we know today perhaps started in 15th century in Italy it got its definite shape after the Paris convention in 1883

Developing countries are also seeking to develop a suitable solution to implement relevant provisions of the CBD, especially those dealing with traditional knowledge and overall access to genetic resources. Developing

countries are seeking intellectual property registration systems that would identify and document the sources of genetic material and also extend IPR to traditional knowledge system, particularly those of the indigenous communities in line with the Article 8(v) and Article 10(c) of CBD.

In India, we can be proud of having the distinction of the first country in experimenting a benefit-sharing model that implemented in Letter and Spirit Article 8(j) of CBD. The author while in Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) in Kerala has demonstrated that indigenous knowledge system merits support, recognition and fair and equitable sharing of benefits. Based on a lead obtained from a Kani tribe of Kerala, JNTBGRI developed an anti-fatigue, immuno-enhancing and anti-stress herbal formulation named 'Jeevani'.

5. Development of "Jeevani" and transfer technology

Based on Ayurvedic pharmacology, the senior author along with Dr. Rajasekaran formulated a new, polyherbal Ayurvedic drug in a granular form, named 'Jeevani'. The term 'Jeevani' means 'elixir of life'. The ingredients of 'Jeevani' are *Trichopus zeylanicus* ssp. *travancoricus* Burkill. ex Narayanan, *Evolvulus alsinoides* (Linn.) Linn., *Withania somnifera* (Linn.) Dunal.and *Piper longum* Linn. Clinical trial of 'Jeevani' was conducted on more than hundred subjects with different backgrounds - 70 % non-healthy and 30% healthy persons. Apart from modern drug efficacy test it was also evaluated on the basis of Ayurvedic pharmacology. It is classified under health promoting ('Swastahita') group of drugs. Subsequently, technology of the drug 'Jeevani' was transferred to a reputed Ayurvedic drug manufacturing company located in Kerala for a period of 7 years and Rs.10 lakhs was received as license fee and 2% royalty was received on ex-factory sales price.

5.1 Benefit sharing

Based on the technology transfer of 'Jeevani' TBGRI has decided to part with 50% of the licence fee and royalty received from the company to the Kani tribal community who provided the lead for the development of the drug. Kani tribe registered a Trust called 'Kerala Kani SamudayaKshema Trust' with the guidance from TBGRI and the benefits received by the technology transfer and royalty were remitted to the Trusts account. Later, in consultation with TBGRI, the Executive Committee of the Trust decided to felicitate the three Kani tribesmen who divulged the information about Arogyapacha. Accordingly, they were felicitated by the trust and given Rs. 20,000/- each (Sri C.Mallan Kani and Sri A.Kuttimathan Kani) and Rs. 10,000/- to R. Eachan Kani (total Rs. 50,000/-) as prizes / compensation. This amount has been taken from the first year interest of the Rs. 5 Lakhs remitted to the trust account. They also decided to keep Rs. 5 Lakhs as the permanent asset of the trust in the bank and only the interest of that money will be utilized for the welfare activities of Kani tribe.

5.2 Pre-benefit sharing effect

Pre-benefit sharing mechanism implemented through the appointment of two informants Sri. Mallan Kani and Kutti Mathan Kani of Choanampara tribal settlement, Kottoor, Thiruvanathapuram district, Kerala

as consultants in the Division of Ethnomedicine and Ethnopharamacology at Tropical Botanic Garden and Research Institute for a period of 7 years from 1993 to 1999. They were benefited with the remuneration paid for Rs. 504000 (@ 3000/ month for 2 persons). This is one of the novelties of ABS Kani model of benefit sharing. This kind of mechanism can be easily adopted when one is planning to develop similar case studies in future.

5.3 Post benefit sharing effect

Some important outcomes of this experimental model are given below.

- Rs. 2500 is maintained as a fixed deposit in the name of two Kani girls aged 8 and 10 whose mother was killed by a wild elephant in 2002.
- Constructed a community Hall with necessary infrastructure facilities
- Purchased a Jeep for transportation of people, marketing goods and Non Wood Forest Produce
- Kerala Kani SamudayaKshema Trust has given employment to two Kani tribesmen as Driver of the Jeep and Helper and both of them are drawing salary every month.
- Telephone facilities have been provided to the office of the Trust.
- Construction of a small building for providing computer facilities to the school children is in progress.
- Established Rain Water Harvesting System

Kani Model of Access and Benefit Sharing (Conclusion)

- Implemented Article 8(j). and Article 15.7 of CBD
- Recognized and rewarded IPR of Kani tribe
- Protected traditional knowledge of Kani tribe
- Extended short term benefits to the informants
- Extended long term benefit to the Kani community

KABS offered several lessons to be learned at various levels. It also signifies the growing interplay between the collective rights, and the monopolistic rights of the WTO regime. The KABS model demonstrates that the traditional communities can be empowered to preserve/protect their traditional knowledge and at the same time enable those to avail their rights while taking their resource and knowledge in the market regime of the modern world.

5.4 Outcome and lessons learned

The sharing of benefits with Kanis and formation of the Kani trust fund have started showing positive impacts in the sense that the tribal community is now becoming conscious about the values of and rights over their knowledge system and associated biological resources. These developments also have helped in bringing the Kani families to a single organizational framework, so that the benefits accrued from the trust fund could be utilized for the economic well being and social development in the Kani tribal hamlets. The Kani tribe is now a proud and dignified community. The trust has a concrete building of fully furnished four rooms (about 2000 sq.ft.) with fully furnished office room, conference hall, library cum reading room and a

store room. The Kani community regularly meets at this building, discuss their problems and take decisions for the welfare of the community. For the first time in the history of the Kani tribe, they feel confident and dignified. They have initiated various welfare programmes for the benefit of their community. Looking back 12 years, it is unbelievable to see the kind of transformation of this otherwise timid, nomadic forest dwelling tribe who used to be scared of outsiders and foresters now standing up with dignity and claiming their rights and privileges. There are now many Kani boys and girls who passed metric and even graduation for which the trust was instrumental. The trust recently acquired a fine 12 seated vehicle and a Kani young man got the driving license and he now drives this vehicle which ply from their habitat to the nearest village market and town. The trust was able to persuade the local authorities to build a motorable road of over 10km inside the forest to the tribal village (Pushpangadan and Pradeep, 2008).

The TBGRI Model perhaps is a unique experiment ever done, wherein the benefits accrued from the developemnt of a product based on an ethno botanical lead were shared with the holders of the traditional knowledge. Considering the significant outcome of this model in community empowerment and income generation and poverty eradication of a tribal community, Pushpangadan was awarded with the UN-Equator Initiative Prize (under individual category) at the World Summit on sustainable development held in Johannesburg in August, 2002. Now with the CBD-Bonn and WIPO guidelines and our national legislation on biodiversity in position, the TBGRI of Kani case study could be taken as an ideal model of equitable benefit sharing involving genetic resources and associated traditional knowledge (Pushpangadan and Pradeep, 2008).

After the expiry of the license period of 7 years JNTBGRI has extended for period for 3 years. After the negotiations for a fresh license against 21 lakhs license fee and a royalty of 4% was agreed up on by the company. In the mean time the company came to know that the patent period is just over and they stopped discussing about it. JNTBGRI was holding only a process patent and they have not done to effect a conversion to product patent. However, JNTBGRI in 2015 has agreed to manufacture Jeevani with the association of Oushadhi (Kerala Government Pharmaceutical Concern) and Kerala Kani Samudaya Trust.

6. Conclusion

Ethnobotanical research can provide a wealth of information regarding both past and present relationships between plants and the traditional societies. Investigations into traditional use and management of local flora have demonstrated the existence of extensive local knowledge of not only about the physical and chemical properties of many plant species, but also of the phenological and ecological features in the case of domesticated species. In addition to its traditional roles in economic botany and exploration of human cognition, ethno-botanical research has been applied to current areas of study such as biodiversity prospecting and vegetation management.The new thinking centered on the concept of 'knowledge engineering' for building up future 'knowledge assistance' and 'knowledge industries' is now gaining attention and acceptance both nationally and internationally. Knowledge based development of value added products from bio-resources and its commercialization has become one of the fastest developing economic activities in the world. Generation of such technology and its commercialization required to be properly safeguarded for measures

of protecting the IPR of the holders of TK so that they could achieve economic prosperity and help in sustainable development.

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