

BIOPROSPECTING

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Bioprospecting is basically the search for commercially valuable biochemical and genetic resources in plants, animals and microorganisms. These resources may be used in food production, pest control and development of new drugs and for other related biotechnological applications. Bioprospecting has primary use for economic purposes (e.g. new drugs, crops, industrial products, etc.). Bioprospecting is also referred to as Gene prospecting. Bioprospecting, in more common usage, is an exploration of Biodiversity for every valuable genetic and / or biochemical resource that finds use in the pharmaceutical industries either through bioprocesses unique to them or through novel end or by-products. Bioprospecting or Biodiversity prospecting covers three aspects such as:

1. Identifying novel organisms and products that have untapped but substantial economic potential.
2. Popularizing and modifying traditional techniques so as to conserve vulnerable taxa and habitats.
3. Conserving traditional germplasms of useful species and their wild relatives for further improvement programmes.

Before 1992, biological resources were considered common heritage of human kind. Scientist could take samples from anywhere in the world without any specific permission. The Convention on Biological Diversity (CBD 1992) re-affirms the sovereign rights of countries over the biological resources within their borders. Though not granted property upon natural resources, biodiversity – rich countries are committed to:

- Conserve their biodiversity
- Develop it for sustainable use
- Share fairly the benefits resulting from this use

Keeping in view the importance of bioprospecting, a network program on "Bioprospecting of biological

wealth using biotechnological tools" was initiated by the Department of Biotechnology, Government of India during Ninth Plan involving thirteen institutions in the country. The objective of the first phase were;

1. Characterisation of biodiversity in different agro ecological regions through remote sensing and GIS (Geographical Information System) based studies.
2. Bioresources mapping, inventorisation and monitoring of biological diversity.
3. Characterisation and conservation of Himalayan endangered species including medicinal and aromatic plants.
4. Bioprospecting of biomolecules and genes for product development.

The first phase has been completed and leads obtained have been taken up during second phase for product development. Thus organized bioprospecting has been undertaken in large scale in India to understand the bioresources and the potential benefits that can be derived from such resources as well as to prevent biopiracy.

Increased interest in bioprospecting is attributable to a decline in innovativeness in the chemical and pharmaceutical industries, the rise of biotechnology as a dominant economic sector, concern over biodiversity loss, the invigorated effort by developing countries to search for new economic activities and advances in the techniques for bioprospecting. Expectations from biotechnological innovations have further stimulated biodiversity prospecting which in turn have stimulated profit motivated steps towards active conservation of bio resources. However, in the absence of strict enforcement of legislation and lack of suitable equitable benefit sharing mechanisms, this gene rush will not only destroy our ecosystems

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but also provide less benefit sharing to indigenous people – the real owners of traditional biodiversity knowledge. One example is *Meytenus buehannani*, the important source of anti-cancer compound Meytansine; its entire population was completely lost from Kenya in a single expedition by the National Cancer Institute, USA.

Already several pharmaceutical multinational companies are screening the plants of tropical forests of several developing countries, which are rich in biodiversity, such as Costa Rica, Brazil, India, Colombia, Chile, etc. Bioprospecting is also increasingly practiced in forest habitats of temperate countries and hypothermal vents deep under the sea. The value has not been estimated to date for many more bioresources obtained from indigenous societies, but is definitely substantial. It should however be mentioned that to date only a small proportion of biodiversity has been exploited; nevertheless there are sufficient indications that the economic potentials of bioresources yet to be exploited are enormous. In this context, bioprospecting is rapidly growing into a new industry on its own merit.

Essentially three methods have been used in the choice of collection of plants resources for bioprospecting

1. Random method – Involves random collection of plants found in an area.
2. Phylogenetic method – Collection of all members of plants in a particular family in which some taxa are already known to be good sources of useful products.
3. Ethno-directed method – collection of plants based on traditional knowledge of tribal people or indigenous community.

According to legal definition, indigenous people are "Politically weak people or community belonging to a culturally distinct ethnic entity and having an identity different from the main stream – national society and deriving subsistence from local resources. International working group on indigenous affairs based at Copenhagen, states that there are approximately 300 – 500 million indigenous people all over the world in which nearly half live in India and China. The knowledge, these people have accumulated over several hundreds of years is termed as traditional or indigenous knowledge. Biodiversity has become a very important tool in highlighting the

significance of Indigenous Knowledge System (Traditional Knowledge System) (IKS or TKS).

The importance of indigenous knowledge, especially with reference to bioprospecting has been grossly underestimated. Advances in scientific documentation and understanding of traditional knowledge have resulted not only in recognizing wild resources for human use and areas rich in them, but also in bringing into focus the sacred bondage that existed between traditional societies and nature. The sacred bondage between Nature and Society was recognised by UNESCO in its 1972 convention on the Protection of World Cultural and Natural Heritage (World Heritage Conference). Pharmaceutical companies and agribusiness use indigenous knowledge as a precursor for screening and this is happening with little regard for the protection of indigenous property and no equitable sharing of profits.

Bioprospecting in developing countries must be operated on a commercial scale as a biotechnology based business that adds value to a natural resource, if it is to provide income to developing countries and their traditional people and incentives for the conservation of biodiversity resources. For e.g. Australia has a huge potential for bioprospecting because it is one of the world's most biodiverse nations. Already American researchers have located a substance in the root of the Western Australian Smoke Bush which has killed some HIV strains in the laboratory. However the rights to this plant have been sold with no regard for the traditional owners of the knowledge of the plant. Some of Australia's major institutions are conducting research into bioprospecting. The Pharmaceutical Research Institute at Griffith University has been focusing on coastal marine organisms and rain forest plants from Queensland looking mainly for products with potential in the cardio-vascular, gastro – intestinal and respiratory areas.

Effective habitat conservation, bioprospecting and sustainable use of biodiversity on a global basis require taxonomic studies and expertise. It is always desirable to carry out genetic analysis in addition to morphological studies to segregate taxonomically difficult taxa particularly at or below the species level and also to understand evolutionary process and reconstruct phylogenetic

relationship in groups of plants. Diagnostic molecular markers can be used to distinguish plants. The integration of molecular studies with other biosystematic data will give information of germplasm and help in bioprospecting.

Many prominent scientists avidly advocate bioprospecting, the systematic search for new commercial applications for biota as a mechanism for inducing tropical diversity conservation by making it commercially attractive. Bioprospecting's premise is that nature contains hidden assets of potentially huge, yet unknown magnitude to human kind that can motivate and even finance biodiversity conservation in the tropics. Bioprospecting can affect social and economic development in developing countries by rewarding biota rich but income poor tropical communities that preserve and wisely manage their genetic resources. Bioprospecting stimulates conservation through two mechanisms.

1. Bioprocessing firms should be willing to pay to preserve biodiversity for its innovation option value since they stand to reap direct financial benefits from any marketable discoveries.
2. Conditions on an increase in life sciences firm's willingness to pay for conservation, local inhabitants and landholder's valuation of biodiversity which change to the extent that they are compensated for their contribution to bioprospecting activities.

The need to conserve precious biodiversity is clear, when we begin to appreciate the magnitude of the spiritual, social and economic services it provides. But bioprospecting is an unpromising base on which rests the economic rationale for conservation. The increasing economic value of biodiverse habitat is central to stemming conversion of marginal lands

through the emphasis on three alternatives.

1. Help host communities better understand and value their fundamental dependants on ecosystem services.
2. Need to emphasize the necessity for wealthy western community that recognise and value biodiversity in distant lands to pay for its conservation, playing of the aesthetic cultural and ethical reasons to value biodiversity conservation.
3. Need to raise the opportunity of costs of conversion by increasing the productivity of the Poor's labour applied elsewhere.

Bioprospecting must follow the new rules of international treaties and national laws. More specifically, it must respect

- § Informed consent (the source country must know what will be done with the resource, and how benefits will be shared; and must give permission for collecting).
- § Fair agreement on benefit sharing (benefits may include support for consideration, research, equipment, technologies, knowledge transfer, development, royalty etc).

Bioprospecting may be considered as biopiracy when these principle are not respected. Some even argue bilateral agreements of bioprospecting between a country or a community and a corporation are a sort of juridical validation of biopiracy towards traditional communities whose values and rights are not considered and respected.

The lecture shall also highlight case studies of chemical and gene prospecting in the medicinal plant wealth of the Western Ghats



VIEWS

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