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Cashing in on biodiversity

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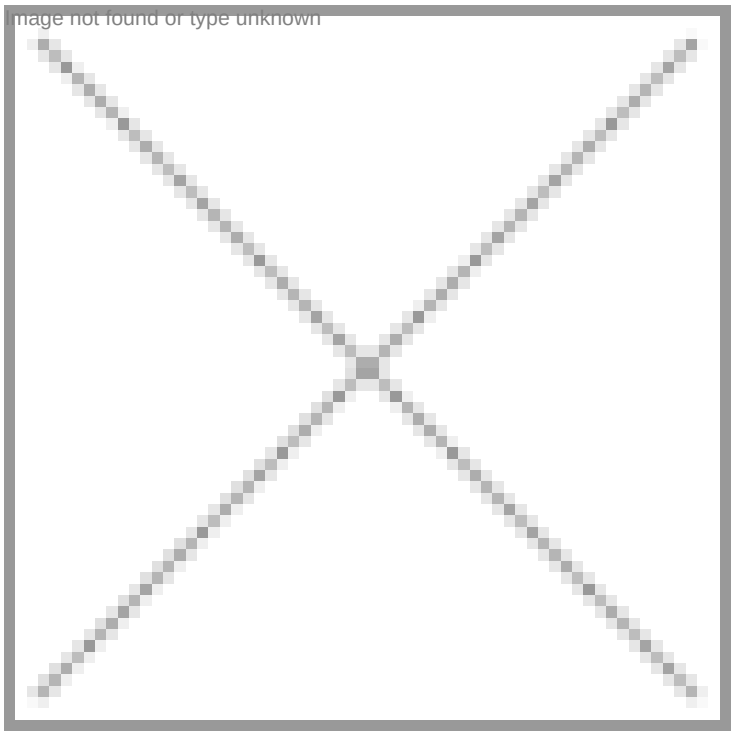

Cashing in on biodiversity

Efforts are on to catalog and tap India's rich biodiversity and convert bioresources into economic wealth.

The importance of bioresources is clearly evident from the example of the terrible Irish famine. In the 1840s, about one million Irish starved and another 1.5 million fled from the country as it was in the grips of one of the worst famines in history. They were victims of the world's most vicious crop disease-the potato late blight. The blight was curbed in the 19th Century when farmers planted blight-resistant varieties of potatoes. However, more aggressive strains of potato late blight have spread around the world and the quest for better potato varieties and new resistant genes continues.

Prospecting

The prospecting for better varieties/genes is not limited to potato alone. It is common to most of the crops. The crucial question here is that from where to source the proverbial "superior gene"? In most cases it leads to "back to the nature trail"; the inherent biodiversity of a country which is the best gene pool to provide viable alternatives to scientists and farmers.

In this context, India is fortunate to be blessed with a rich biodiversity. It is one of the twelve mega biodiversity regions of the world and is home to three of the 28 global hotspots. We have an estimated 89,450 described species accounting for about 7.3 percent of the global biodiversity. "However, data on most of these is highly scattered and not easily accessible. Indeed, the lack of readily available information on how much of what bioresources occur where, has become a limiting factor in

bioprospecting and converting our natural biowealth into economic wealth", averred Dr S Natesh, advisor, department of biotechnology (DBT), New Delhi.

Mapping bioresources

To remedy the situation, the National Bioresource Development Board (NBDB), set up under the DBT, initiated a country-level program with the agenda to develop a digitized inventory of the biological resources of the country from already published information. The diligent work of about 400 scientists from 150 institutes across the country, for over four years, saw the compilation of Jeeva Sampada-the first ever digitized inventory of India's vast bioresources made available on a set of ten CDs. This contains essential information on taxonomy, distribution, images, uses, chemical composition, economic potential and literature on about 2,700 medicinal and economically important plants (titled Sasya Sampada), nearly 9,000 species of animals, over 17,000 microbe species and about 7,000 marine species.

"This program is unique in several respects. It is for the first time that the data on a large number of diverse groups of organisms were compiled on a completely indigenously developed common software platform. Comprising 82,00,000 records for over 39,000 species, Jeeva Sampada is easily the most exhaustive and largest bioresource database (about 7 GB) ever in the country," explained Dr Natesh. This digitized inventory was released by Kapil Sibal, union minister for science and technology and ocean development, in July this year.

Currently, under the NBDB, the mapping and quantitative assessment of bioresources of Western Ghats is going on. The entire stretch has been divided into nearly 1,600 grids of 10x10 km each and for the first time a detailed resource map of the area is being prepared. A similar initiative on quantitative assessment and mapping of bioresource of the entire stretch of Eastern Ghats covering Orissa, Andhra Pradesh, Tamil Nadu and some parts of Karnataka has also been started this year.

Indian Bioresource Information Network (IBIN)

In addition, the DBT along with the department of space, have compiled vital information on biodiversity characterization at landscape level using satellite remote sensing and geographic information system. This spatial data along with the biodiversity related non-spatial information has now been made available via a web-enabled portal, Indian Bioresource Information Network (IBIN). This integrated database aims to network and promote an open ended co-evolutionary growth among all the digital databases related to biological resources of the country. "Additionally this exercise will also reveal gaps in our knowledge and the directions in which we need to concentrate future work. This is just the beginning and the task is by no means complete," said Dr Natesh.

Search for novel genes and molecules

The prospecting of natural resources has also led to the discovery of many novel genes and molecules. For example, 96 stress-related genes have been isolated and 18 full length genes characterized; genes for drought tolerance have been identified from Prosopis juliflora; Salt tolerant genes isolated from mangrove (Avicennia marina) have been transferred to rice; Superoxide Dismutase (SOD) enzyme isolated and characterized from high altitude plants is being used for an antioxidant skin cream among others.

Three botanical pesticide formulations have shown positive results against insects like Plutella xylostella, Aphis craccivora and the mosquitoes. These formulations will soon be put for limited scale field trials for further evaluation. The biopesticide formulation developed from plants of Myrtaceae family has been found to be effective against the American Bollworm Helicoverpa armigera and the multilocational field trials on cotton and chickpea being conducted under ICAR. The isolated bioactive compounds are being characterized.

In addition, three potential natural coloring dyes have been shortlisted, while, two color extracts (red color developed from flower petals of Rhododendron arboretum and a beta carotene rich yellow color developed from Dunaliella salina) have been found to be non-toxic. The industrial negotiations are in progress.

Resource-specific programs

Notable achievements of the bioresource-based specific crop programs include developing a 25,000 EST (Expressed Sequence Tags) database of sugarcane and developing PCR-based diagnostic kits for red rot and smut diseases of the crop. These kits are currently undergoing validation. In the case of coffee, the complete genome has been characterized. About 150 microsatellite markers have been developed and the transformation system for transgenics for low caffeine and pest resistance has also been developed. For tea, about 2000 clones have been identified for molecular characterization and about 150 clones characterized using molecular tools while the transgenics for dormancy and blister blight have been

developed.

Butterfly park

An important initiative, the first butterfly park of the country has been established at Bannerghatta Biological Park, Bangalore, which serves as an integrated centre for research, education and rural livelihood. Explaining the rationale behind this venture, Dr Natesh, said, "Biodiversity is a sum total of all that exists in the environment: microorganisms, tiny plants, animals and trees. Butterflies, besides being ecologically and economically important, will help us in flagging the issue that conservation and biodiversity is not only about one big plant or animal alone but a variety of things put together." Spread over an area of 7.5 acres, it comprises a butterfly garden, butterfly conservatory and a museum. The 10,500-sft dome shaped conservatory meets all possible habitat requirements including host plants and houses butterflies throughout the year. The butterfly park is currently undergoing as trial run with about 2,000 butterflies of 12 species being released every week. Soon 13 more species will be added for a greater diversity. Currently, the rearing protocol for 42 species has been completed and the DNA fingerprinting completed for 10 species. In addition, a species inventory and a butterfly calendar have been prepared. The park was formally inaugurated by Kapil Sibal recently.

All put together, these efforts are making a huge impact towards development and sustainable utilization of the bioresources.

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