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Ethnobiology, ethnobotany, ethnomedicine and traditional knowledge with special reference to India

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Abstract

Ethnobiology is the scientific study of the plants and animals as treated or used by different traditional communities. Early man looked for the best nutritious food to have a healthy and disease free long life from the surrounding environment. This effort has resulted in selecting a large number of food items by human communities who lived in different parts of the world. The early humans perhaps combined instinct with indulgence to select his food items. Countless members from various human communities who spread to the different parts of the world, continued to expand the food basket. Since the early 1970s, different groups in various Universities and Research Institutions have been working on ethnobotany and traditional knowledge system of the region and published several reports. Most of the publications were concerned with ethnobotany or agricultural operations including shifting cultivation and festivals of the region. Ethnobotanical reports were mainly on ethnomedicinal plants with a few publications on food and beverages. The ethnomedicinal publications in most cases cited only the names of plants, used without going into the details of the method of use, the quantum of use and other related aspects. During 1980s, the Ministry of Environment and Forests (MoEF), Govt. of India launched an All India Co-ordinated Research Project on Ethnobiology (AICRPE), to document ethnobotanical and ethnozoological informations on plants and animals used by the indigenous people of India. The growth and development of ethnobotanical studies in India and elsewhere are briefly reviewed in this article.

Key words: Ethnobiology, ethnobotany, ethnomedicine, biodiversity, traditional knowledge, history and development

Introduction

The history of human culture and civilization is all about the management and utilization of the resources around him. Since the dawn of human civilization, resources particularly the bioresources have been utilized by diverse human communities. Human beings started their life in the forest as an integral part of the forest ecosystem. Living close to nature he has acquired unique knowledge about the ambient biodiversity by instinct, trial or error and experimentation and used a variety of plants and animals to meet his essential requirements like food, medicine, fuel, fibre, *etc*. Being an intelligent and innovative organism he very soon built a material civilization of his own and carved out a separate habitat for himself, utilizing the resources around him. Many human communities later established civilizations and began to live in villages, towns and cities built by them. However, a good majority of the human communities still continue to live in and around the forest ecosystems. The communities who left the forest and began to live in modern towns and cities, gradually lost close touch with nature and forest and lost the precious knowledge about most of the wild plants

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which their forefathers had. By the turn of the 20th century, the peaceful life of the traditional communities used to live in and around the forest was also disturbed and disrupted and that led to the decline and destabilization of these people, causing imminent danger of extinction of the precious/peculiar life style, culture and knowledge system (Pushpangadan, 2005).

Ethnobiology is the study of the complex relationships between plants and animals over centuries. The focus of ethnobiology is on how plants and animals are used or, managed and perceived in human societies and includes plant and animal products used for food, medicine, divination, cosmetics, dyeing, textiles, shelter, tools, currency, clothing, rituals, social life and music *etc*. Ethnobiology is a multidisciplinary science defined as the interaction between plants, animals and people. The relationship between plants and animals with human cultures is not limited to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation and health care (Schultes, 1992).

Quantitative and experimental ethnobiology includes basic documentation, quantitative evaluation of use and management and experimental assessment. Today, ethnobiological surveys include applied projects that have the potential to ameliorate poverty levels of the people, allowing them to make more educated decisions about their future directions. These new approaches enhance the quality of the science, provide compensation for the cultural groups and take into account environmental concerns.

Early history of ethnobiology

The dawn of human culture and civilization emerged nearly 12,000 years ago. According to social anthropologists and botanists, cultivation of plants started somewhere on the banks of the rivers, Tigris and Euphrates in the present day Iraq by a small human community. It was indeed a very revolutionary discovery. For the first time in the history of Earth, one of its species was able to produce food by domesticating and ultimately cultivating them. Barley, oats, wheat and sesamum were perhaps the first plants that humans domesticated and cultivated. Very soon such domestication and cultivation were spread to other human communities who spread out further into other fertile areas on the Earth. But he continued to supplement his food and nutrition from the wild sources as well. Second group of plants he domesticated could have been herbs, shrubs and later trees that yielded him edible leaves, flowers and fruits.They were indeed the first ethnnobotanists of the world. By trial or error, they have perfected the cultivation of edible plants and plants for treating ailments or alleviating human sufferings. Within 5000 years of the discovery of agriculture, a large number of human communities began to advance very fast and they established a new pattern of human habitats by clearing forests. By 6000 BC, there were well established civilizations in many parts of world, the well known among them being Babylonian, Sumerian, Egyptian, Chinese, Indian and South American civilizations (Pushpangadan, 2005).

By 3500 BC, we find a highly advanced and well organized city civilization emerged at Mohan jo daro and Harappa in the Indian subcontinent. All these civilizations were built by agricultural societies who got more leisure time that stimulated them to build material culture and civilization. But by the turn of the 10th century, human communities in the world over have selected over 10,000 plant species as source of his food. These included many grains, millets, tuber and rhizomes which formed his main energy source and lentils, pulses, nuts, fruits, leaves of many plant species. These plants provided him proteins, fats, vitamins, minerals *etc*. The nutritional requirements were further supplemented by fish and meat. Many communities selected the best nourishing food items. In fact, the brain development of humans were closely associated with certain specific proteins/amino acids and fatty acids. Communities who settled in a particular environment/habitat began to select certain plants and perfected them by trial, error, empirical reasoning or experience which was time and again improved. The innovative, and enterprising members of the community went on generating new knowledge and these were passed on to successive generations which is now known as traditional diet or ethnic food items. It was with colonization which started in 16th century that led to globalization of food and diet. During 18th and 19th centuries, the colonial powers of the West who reached the biodiversity rich South countries began to make intercontinental exchange of plants, which predominantly included the edible plants. This globalization of food and nutrition had its advantage as well as disadvantages. Most undesirable outcome of this globalization of food was the narrowing down of the food basket by the world population. In the whole world, humans began to be fed by 20 edible plants by the turn of the 19th century against over 7,000 or more species that provided food and nutrition to the humans till the turn of the 18th century. With the increasing scientific knowledge and understanding on the food and nutrition, it is now well known that the location specific and climate specific food are best suited to humans (Pushpangadan, 1995).

In India, much literature, relevant to ethnobiology can be traced in the vedic literature. Shusruta and Charak samhita are the most important works. India had a large forest cover which yielded a number of medicinal plants and animal products. These plants and animal products were used extensively in Ayurvedic system of medicine since several millennia.

Search for the best nutritious food to have a healthy and disease free long life has always been both a desire and incessant effort of humankind eversince his evolution as ***Homo sapiens*** (Man, the wise). This has resulted in the

selection of a large number of food and medicinal items by various human communities in different parts of the world. Early humans began to combine instinct with indulgence and selected more and more food items initially from flora and later from the fauna. He has also added more foods by watching the animals and at times by intuition. Countless members from various human communities who spread to the different parts of the world, thus, continued to enlarge the food basket. It was by a process of trial, error, experimentation or by empirical reasoning or intuition *etc*. that the early humans tested and selected plants and animals for new source of food, nutrition and medicine. Hundreds of them might have died while doing the test eating of poisonous plant and animal products during such clinical trials. It is believed that almost 99.9% of the time of human life, since his evolution about 1.5 million years ago was spent in the forests. It was during this long period that the ancient progenitors of humans tested the articles around him, mainly plants for his food and nutrition.

It was mainly for preventing or treating the diseases and for food that man has started exploring plants and animals and that have led to the evolution of traditional system of medicine. The traditional medicine in India functions through two social streams. One is the local folk stream which is prevalent in rural and tribal villages of India. The carriers of these traditions are millions of house wives, thousands of traditional birth attendants, bone setters, practitioners skilled in acupressure, treatment of eyes, snake bites *etc*. and the traditional village level herbal physicians, "the vaidyas" or tribal physicians in the tribal areas. These local health traditions thus represent an autonomous community supported system of health delivery at the village level which runs parallel to the state supported system. Its potential goes largely unnoticed because of the dominant western medicines.

The second level of traditional health system is the scientific or classical systems. This consists of the codified and organized medical wisdom with sophisticated theoretical foundations and philosophical explanations which are expressed in thousands of classical and regional manuscripts covering treatises on all branches of medicine and surgery. Systems like Ayurveda, Siddha, Unani, Amchi, Tibetan *etc*. are the expressions of this stream.

Both the above streams of medicine are deeply rooted in the tradition, culture, civilization and religion of our land and people. Ayurveda, the ancient science of life had its origin in the northern centers of learning and slowly this system attained a preeminent position in the entire country. Siddha system, believed to be originated by the sage Agasthya remained mainly in South India particularly among the Tamil speaking population of India. The Amchi and the Tibetan systems were popularized by the Buddhist monks in the Himalayan region of India. Unani system which was brought by the Mughal rulers, gained popularity among the Urdu speaking populations in the country. A significant aspect of ethnobotany in medicine (ethnomedicine) is that it is self reliant nature. Ethnomedicine is entirely autonomous in character and rooted deep in the communities social tradition and knowledge system.

In AD 77, the Greek surgeon Dioscorides published "De Materia Medica", which was a catalog of about 600 plants in the Mediterranean. It also included information on how the Greeks used the plants, especially for medicinal purposes. This illustrated text contained information on how and when each plant was gathered, whether or not it was poisonous, its actual use and whether or not it was edible (it even provided recipes). Dioscorides stressed the economic potential of plants. For generations, scholars learned from this herbal, but did not actually venture into the field until after the Middle Ages. In 1542, Leonhart Fuchs, a Renaissance artist, led the way back into the field. His "De Historia Stirpium" cataloged 400 plants native to Germany and Austria. John Ray (1686-1704) provided the first definition of "species" in his "Historia Plantarum": a species is a set of individuals who give rise through reproduction to new individuals similar to themselves. In 1753, Carl Linnaeus wrote "Species Plantarum", which included information on about 5,900 plants. Linnaeus is famous for inventing binomial method of nomenclature, in which all species get a two part name (genus, species).

Theophratus (370 to 286 BC), a pupil of Aristotle (384 -322 BC) is often considered as the "Father of Botany". He proposed a system of classification placing them under four groups- trees, shrubs, under shrubs and herbs. In general, this classification was followed by all till the time of Linnaeus (Manilal, 2012). The publication of Hortus Malabaricus (1678) at Amsterdam marked the first publication of Asian plants. It is the first comprehensive treatise on the economically valuable natural plant wealth of Malabar. It contained 791 illustrations and descriptions of 742 plants, belonging to 691 modern taxa closely connected with the history of modern Botany. The book was one of the main source of Linnaeus for knowledge of principal flora of Asia (Manilal, 2012). Ever since the publication of Hortus Malabaricus, many famous researchers from all over the world had been fascinated by the plants mentioned and illustrated in it. The attraction produced by them have enthralled and enchanted them irrespective of the country and location of their origin, compelling many of them to undertake serious researches on the part of Malabar mentioned in the book of Rheed and Van (1682). No other region of India contributed so many vernacular Indian plant names to Species plantarum (Manilal, 2012). The Malayalam language is also indebted to Linnaeus for immortalizing such a large Malayalam plant names for first published by Rheed and Van in his Hortus Malabaricus about a century before.

The term Ethnobotany was coined by US botanist John William Harsh Berger in 1895 to refer the study of plants, used by the aborginals of Australia. It was refined again and again by various workers. According to Martin (1995), the term Ethnobiology implies an explanation on local people's perspectives on cultural and scientific knowledge. It includes everything from interaction, interrelation of human communities with plants. Generally, Ethnobotanical investigations are dealing with the study of use of plants by traditional communities. It is essentially a multidisciplinary investigation on the multidimensional perspectives of the life, culture and tradition and knowledge system of traditional communities with the ambient vegetation. Ethnobotany also refers to the study about the utilization of plants for a wide variety of human needs such as food, medicine, fodder, fibre, and goods required for his material culture and amenities. Ethnobotany is the study of the relationship between plants and the people (Choudhary *et al.*, 2008).

The 19th century saw the peak of botanical exploration. Alexander von Humboldt collected data from the new world and the famous Captain Cook brought back information on plants from the South Pacific. At this time, major botanical gardens were started, for instance the Royal Botanic Gardens, Kew. Edward Palmer collected artifacts and botanical specimens from North American West (Great Basin) and Mexico from the 1860s to the 1890s. Once enough data existed, the field of "aboriginal botany" was founded. Aboriginal botany is the study of all forms of the vegetable world which aboriginal peoples use for food, medicine, textiles, ornaments *etc*.

Research in ethnobiology and ethnobotany in 20th and 21st century

Very little organized work had been done in India till about 30 years ago. Organised field work and other studies in the subject were started in the Botanical Survey of India. Also there has been a resurgence of interest developed in ethnobotanical research in various institutions. Dr. E.K. Janaki Ammal initiated researches on ethnobotany in Botanical Survey of India (BSI). She studied food plants of certain tribals of South India. When the senior author of this paper joined Regional Research Laboratory, now known as Indian Institute of Integrative Medicine, Jammu under Dr. Janaki Ammal for about 8 months, she has fondly told the senior author about the importance of doing ethnobotanical studies in South India. However, I could do it only after 1984 when I started research in Ethnobotany (Pushpangadan and Atal, 1984, 1986). From 1960, Dr. S.K. Jain from BSI started intensive field work among the tribals of Central India. He devised methodology for ethnobotany particularly in the Indian context. The publications from this group in the early sixties triggered the ethnobotanical activity in many other centres, particularly among botanists, anthropologists and medical practitioners in India (Bondya *et al*., 2006; Bora and Pandey, 1996; Borthakur, 1981a, b, 1990, 1996; Borthakur and Gogoi, 1994; Hajra, 1981; Hajra, and Baishya, 1997; Jain, 1987,1991,2002, 2005, 2006, 2010; Jain and Goel, 1987, 2005; Jain and Sikarwar, 1998; Jain and Dam, 1979; Jain, A. *et al*., 2007; Jain, S.C. *et al*., 2009; Jain *et al*., 1994, 1997; Janaki Ammal, 1956; Joshi, 1995; Joseph and Kharkongor, 1981; Manilal, 1978, 1980a,b,c, 1981, 1996, 2005, 2012; Manilal *et al*., 2003; Mohanty, 2003, 2010; Mohanty and Rout, 2001; Patil, 2000, 2001; Pushpangadan, 1986, 1990; Pushpangadan *et al*., 1995, 2012; Pushpangadan and Dan, 2011; Pushpangadan and George., 2010; Roma Mitra, 1998a,1998b; Singh *et al*., 2011; Subramoniam *et al*., 1997,1998; Vartak, 1981; Vartak and Gadgil,1980,1981). During the last four decades, similar work has been initiated at various centres such as National Botanical Research Institute (NBRI) at Lucknow, National Bureau of Plant Genetic Resources (NBPGR) at Delhi, Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Palode, Central Council of Research in Unani Medicines (CCRUM), Central Council of Research in Ayurveda and Siddha (CCRAS) and in some other institutions.

Human strategies for survival have long depended on the ability to identify and utilize plants. Generations of experience-success, failure, intuition, accidental discovery, error, trial, or empirical reasoning *etc*. might have contributed to building a broad base knowledge on individual plant species and its value/utility and this was transmitted to later generations. Incremental improvements in managing and utilizing such resources were made by successive generations.

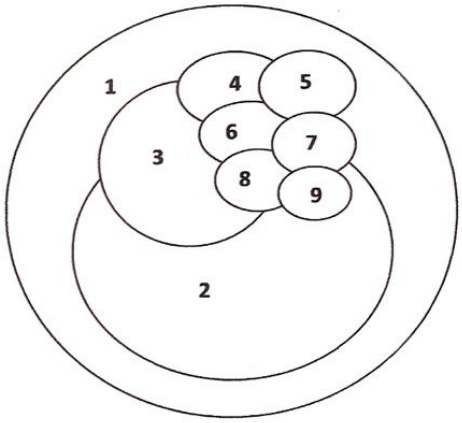
All India co-ordinated research project on ethnobiology (AICRPE), 1982-1998

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 Professor M. S. Swaminathan, the then Director General, ICAR. Professor M.S. Swaminathan felt the urgent need to undertake an ethnobiological study of the tribals 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), formerly launched the project in July 1982 under the Man and Biosphere Programme (MAB) of UNESCO. When the Ministry of Environment and Forest (MoEF) came into being, the MAB programme along with AICRPE was transferred to MoEF. In September 1983, MoEF set up a

co-ordination unit at Regional Research Laboratory (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 supervision, 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 tribals 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 multidisciplinary 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) are oral in tradition 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 (Ayurveda, Siddha, Unani, Amchi *etc*.) makes use of only about 2500 plants whereas we have a database on 10,000 plants which requires further scientific validation. Out of this, 8000 wild plant species are 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 as subsidiary food /vegetable by tribals. About 8000 are new informations and atleast 250 of them are worthy of investigation. Out of 400 plant species used as fodder, 100 are worthy recommending for wider use and out of 300 wild species used by tribals as piscicides or pesticides, atleast 175 are quite promising to be developed as safe pesticides (Pushpangadan, 1995).



Utilization pattern of wild plants by tribals of India

Figure 1: 1. Total (10000), 2. Medicinal (8000), 3. Edible use (4000), 4. Other Material and Cultural Requirements (750), 5.Fibre and Cordage (600), 6. Fodder (500), 7. Pesticides, Piscicides *etc*. (325), 8. Gum, Resin and Dye (300), 9. Incense and perfumes (100). (Pushpangadan, 2002; Pushpangadan and Pradeep, 2008).

The traditional communities thus became a treasure trove of accumulated knowledge and wisdom about the management and utilization of various plants and other materials around him. Due to modernization, the precious knowledge system have been eroding and corroding fast and at times getting totally disappearing during the last many years. It was the realization of this fact that researchers from many countries around the world were motivated to undertake ethnobotanical investigations to document the traditional knowledge and wisdom of the people. It is now well recognized that the traditional wisdom and knowledge on utilization of the biological resources is of immense value to biodiversity planners and scientists in developing strategies in conservation, utilization and generation of wealth from the bioresources. Bioscientists consider that ethnobiological/ ethnobotanical knowledge system as a first effective means for identifying as well as locating alternative food sources and leads for drugs and pharmaceuticals, natural dyes, colours, gums, resins, *etc*.

Ethnozoology

The Ethnozoological investigations undertaken by the Zoological Survey of India (ZSI). Centres located in different parts of the country, have made extensive survey and have recorded the use of domesticated and wild animals, including birds for food, medicines, costumes, games, religious purposes *etc*. A number of interesting, but lesser known or hitherto unknown use of many birds and animals for food, medicine have been recorded. Over 100 animals or animal products including birds have been used for food by the tribal communities of India. Some of the common animals like wild bore, chital, sambar, cow, monkey, tortoise, frog, crab, prawn, insects, molluscs *etc*. are in great demand.

About 76 species of animals / animal products have proved to be the vital source of tribal medicine. Of these, 16 species are invertebrates like insects, crustaceans, arachnids, molluscs *etc*. and 60 are vertebrates. The latter includes six species of pisces, one species of amphibian, nine species of reptiles, 16 spp. of aves and 26 spp. of mammalian including human beings. The invertebrates are generally used as a whole, while in case of vertebrates, the body parts, tissues, exoskeletons, flesh, blood, bile, fat, bones, gastrointestinal tracts, *etc*. are used. Likewise animal products such as honey, egg, milk, spider net, urine and faeces are of vital value in curing many diseases. The diseases known to be cured with the help of animal drugs, are too many, such as tuberculosis, rheumatic and joint pain, asthma, piles, pneumonia, night blindness, impotency, paralysis, weakness, cholera, body ache *etc*. In other words, to get diseases cured, the dependable source of medicine was either plants or animals since the modern medicines were completely unknown to them. However, the overall development in recent times in the country is bringing rapid change in their treatment pattern with increased use of modern medicine.

125 applications involving birds in treating variety of human ailments have been recorded in detail. While the modern medicine is turning to animal products like liver, insulin from pancreas, fibrinogen from blood, plasma, serum, adrenalin, thyroxin *etc*., it is interesting to note that the tribals use many products like blood, bones, marrow, bile, liver, urine, excreta in treating a variety of diseases. Scientific investigations to test the efficacy of some of the interesting animal products have been initiated at some research centres.

Due to various reasons, there has been a gradual decline and deterioration of the tribal medicine which provided effective medicare for tribals for ages. The significant aspect of the local health tradition particularly that of the tribals is itself reliant nature. These traditions are entirely autonomous in character and rooted in communities, social traditions, knowledge system and local resources, and are easily revitalized without much cost. These are also holistic and very comprehensive in their approach. Therefore, revival and revitalization of this system by improving its scientific base and updating the technology are essential at a time when we are anxious to achieve the cherished goal of 'Health for all'. The tribal medicine, if revived and revitalized, can effectively meet the primary health care needs of the tribals, perhaps, even non-tribals in many cases. Preparing a compendium/ pharmacopoeia of tribal medicine of the country shall be a meaningful exercise in this context (Pushpangadan and Pradeep, 2008).

Workshop on ethnobiology and tribal welfare

A National Workshop on Ethnobiology and Tribal Welfare was organized on behalf of the Ministry of Environment, Govt. of India in association with the International Institute of Ayurveda (IIA), Coimbatore, Tamil Nadu by the AICRPE Co-ordination Unit. The workshop was held from 1st to 3rd November, 1985 at Patanjilipuri Campus of the IIA, Coimbatore. The aim of this workshop was to bring together the senior administrators, planners, scientists, voluntary agencies associated with tribal welfare programmes as well as the tribal representatives in order to interact and evolve ways and means by which the information generated from AICRPE could immediately be translated into action. The workshop was attended by 185 participants, consisting of 30 administrators at the level of Secretary, Directors and Forest Conservators, 35 Scientists, 60 representatives from leading voluntary organisations and 60 tribal representatives. The three days deliberation emerged in the context of the fact that destruction of the material resource base due to deforestation caused great hardship and economic misery to tribals. The workshop after discussion on the various issues and problems of the tribals and also keeping in view of the AICRPE project findings, made specific recommendation for improving the socio-economic status and quality of life of the tribal people. The conference made some recommenda-tions and submitted to the Ministry of Environment and Forests, Govt. of India (Pushpangadan, 1993).

Another National Conference as part of the AICRPE, to streamline the traditional knowledge towards a *sui generic* regime in the post WTO scenario named 'Dhishana 2008' was organized during May 23 to 25, 2008 at Thiruvananthapuram, Kerala. This conference was organized in association with the Ministry of Environment and Forests, Government of India. This was also supported by the other ministries and agencies of the Govt. of India, *viz.* NMPB, CAPART and DST. The major objective of the conference was to evolve appropriate *sui generic* mechanisms in the context of CBD, WTO and TRIPS requirements. Scientists, legal luminaries, policy makers and activists together with representatives of TK holders from tribal and nontribal backgrounds came together for this purpose. The conference came out with the Thiruvananthapuram Declaration on Traditional Knowledge (TDTK), a landmark document on TK and biodiversity, with focus on tribal communities of Kerala (Pushpangadan and Pradeep, 2008).

India has the distinction of being the first country in the world in experimenting a benefit-sharing model that implemented the Article 8(j) of CBD, in letter and spirit. It was Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) in Kerala (where Dr. P. Pushpangadan was Director) that demonstrated indigenous knowledge system merits support, recognition and fair and equitable compensation. The model, which later on came to be known as "TBGRI Model" or "Kani Model" or "Pushpangadan Model", relates to the sharing of benefits with a tribal

community in Kerala, the Kanis, from whom a vital lead for developing a scientifically validated herbal drug (Jeevani) was obtained by scientists of JNTBGRI. The JNTBGRI Model has got wider acclaims, acceptance and popularity the world over, because it was the first of its kind that recognized the resource rights and IPR of a traditional community by way of sharing equitably the benefits derived out of the use of a knowledge that has been developed, preserved and maintained by that community for many generations (Anand, 1998; Anuradha, 1998; Bagla, 1999; Gupta, 2002; Mashelkar, 2001). Further, it demonstrates the vast and as yet under - explored or untapped potentials of the Indian traditional knowledge systems, particularly the traditional health care practices of the local and indigenous people in India.

Conclusion

Ethnobiological 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 not only about the physical and chemical properties of many plant species, but also 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, ethnobotanical research has been applied to current areas of study such as biodiversity prospecting and vegetation management. It is hoped that, in future, ethnobotany may play an increasingly important role in sustainable development and biodiversity conservation. In interaction with the traditional areas of science, ethnobiology gives out several interrelated and interdisciplinary subjects and link ethnomedicine, ethnoarchaeology, ethnobryology, ethnoecology, ethnoagriculture, ethnonarcotics, ethnopharmacology, *etc*.

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Conflict of interest

We declare that we have no conflict of interest.

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