

## The Genesis and Journey of Ethnobotany: From Ancient to Modern

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It is a well-known fact that plants are the earliest organisms on our planet. Animals and humans developed much later and are dependent on plants for their primary and basic needs. In the course of development of civilization an intricate relationship has developed between man and plants. For day-to-day requirements, the early man found several plants and their parts as useful while many others as un-useful. This knowledge of acceptance and avoidance of plants got developed after a long process of trial and error, which must have taken a long time. During ancient period man on this earth would have hunted in the jungles for food to satisfy his hunger and searched for some materials like, bark and foliage to protect himself from rigors of weather. That search was the birth of ethnobotany and ethnozoology or ethnobiological enquiry and field research (Jain, 2006). The ecological and social problems of the unsustainable lifestyles and consumption pattern associated with modern civilization have resulted in a rekindling interest in ethnobiology (Swaminathan, 1996).

Various evidences indicate that human culture and civilization emerged nearly 12,000 years ago. Social anthropologists and botanists gathered several such evidences which reveal that cultivation of plants started somewhere on the banks of the rivers Tigris and Euphrates in the present day Iraq by a small human community (Pushpangadan, 2016). Barley, oats, wheat and sesamum were perhaps the first plants that humans domesticated and cultivated. Later on other human societies also cultivated these crops. Further, several species of herbs, shrubs and grasses were also domesticated. They were indeed the first ethnobotanists 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 5,000 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 6,000 BC there were well established civilizations in many parts of the world the well known among them being Babylonian, Sumerian, Egyptian,

Chinese, Indian and South American civilizations (Pushpangadan, 2005).

Nearly 3500 BC, a well organized civilization emerged at Mohenjo daro and Harappa (Now in Pakistan). The people of that civilization were mainly dependent on agriculture. From excavations at such sites it was found that the people of that civilization were well acquainted with plants. But by the turn of the 10th century human communities selected over 10,000 plant species the world over as source of food. 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 southern 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 effect of this globalization was narrowing down of the food basket. By the turn of the 19th century the whole world was fed by 20 edible plants against over 7,000 or more species that provided food and nutrition to them till the turn of the 18th century. With the increasing scientific knowledge and understanding about the food and nutrition, it is now well known fact that the location specific and climate specific foods are best suited to humans (Pushpangadan, 1995).

The journey of ethnobotany from those early beginnings through ages has been long. It passed through the period of selective use, more credibility for some plants for food and medicine, settled life, primitive agriculture and domestication. Ethnobotany became established as a genuine academic and research activity in the second half of twentieth century, i.e. about the period when certain movements or concerns such as, prospect of leads from indigenous knowledge for new molecules for curing diseases, importance of more adaptable land races in breeding agriculture crops, role of indigenous people in conservation of biodiversity, and also awareness among the indigenous communities for recognition and due compensation for their knowledge, caught global attention



and became national and international priorities. Ethnobotany brings out man's relationships with bioresources, with greater emphasis on cultural, spiritual and social aspects.

### Biological and Cultural Diversity

Biological diversity that is seen today is the result of millions of years of evolutionary process. It is measured in terms of genetic diversity (diversity within the species), species diversity (diversity at species level), and ecosystem diversity. The cultural diversity is the result of association of human beings with biological diversity. Cultural diversity in terms of ethnic groups gives us knowledge on the value of plant resources. Various cultural activities in terms of rituals, festivals, worship, faith, beliefs, etc., revolve around a large number of plant species. The cultural diversity developed among various civilizations/indigenous communities of the world according to the available biodiversity of that region. They started offering/worshipping and using plants in various rituals and ceremonies. Traditions, customs, totems and taboos leading directly or indirectly to conservation of biodiversity or healthy environment (like taboo to eat certain foods before they are ripe for regeneration, making musical instruments and most other wooden articles of daily requirements from only naturally fallen branches or trees, collecting fuel wood from forests, etc.). The knowledge of ethnic groups on the cultural, spiritual, social and economic values of plants can be of immense use to the entire humankind. Ritualistic, symbolic and religious associations with bioresources are more deep-rooted in cultures, than the material uses of bioresources. These human relationships with bioresources keep evolving and changing. Exploitation or protection of bioresources, which is usually also selective, influences the distribution, abundance and consequently availability, which in turn compels modification or substitution in man-plant or man-animal relationships. Political and socio-economic changes, advent of new style of living, vocations, even exotic species also alter the interrelationships (Jain, 2000).

### Oral transfer of knowledge

For millennia, humans have used plants, in addition to a source of food, as medicine, dyes, textiles, construction materials, weapons, tools, currency, clothing and in rituals associated with social life. Before the script writing began, this information, essential for human survival, would have been passed down from generation to generation entirely by oral means. The importance of plants can be found in non-verbal expressions of culture in the form of paintings, monuments, statues, carvings and evidence of plant remains. Explorers and traders have also played a great role in transferring the ethnobotanical knowledge as well as the distribution of several plants. Throughout history, they have described the plants used by indigenous peoples for economic or health reasons.

### Animal's Behaviour

The tenacious bond between the mankind and vegetal world dates back prior to the dawn of civilization. During Paleolithic era or even before that forests happened to be the largest pharmacy and we used to rely virtually on the goodness of the therapeutic and curative properties of plants for the treatment of various diseases. During those days we took few lessons from the wild animals by the way of observing their activities. One of the cumbersome ways of learning through observation was seeing the predatory carnivorous animals frequently browsing on a very common species of grass called *Cynodon dactylon* (*dub* grass) to get relief from the upset stomach. In plant-animal interactions, bioactive defense compounds target the biological systems of herbivores, including the nervous, digestive and endocrine organs, and are produced both constitutively and upon induction. Alkaloids such as nicotine, morphine, strychnine, and cocaine, which are well known for their pharmacological effects in mammals, have probably evolved as defenses against insect herbivory

These days too, we get surprised by the uncanny habit of our pet dogs or cats, chewing and ingesting this humble grass to treat flatulence and bloating. Many herbs of ancient origin, such as species of *Genum* (used by deer against injury), use of hartworts (*Tordylium apulum*, Apiaceae) by dogs to ease parturition (action of giving birth), were obtained by actual observation and experimentation. Another instance of herbal power knowledge of ancient Egypt is evident in the mummification technique. People had good knowledge on plants and prepared herbal pastes for the preservation of dead bodies.

### The development of Ethnobotany

For better understanding the journey of ethnobotany can be divided into following four phases:

- I. **Ancient period to 17th century:** when oral traditions and early written texts described uses of plants.
- II. **18th century to 19th century (The economic objective):** During this period the main emphasis was on economic botany or indigenous uses of plants for monetary gain.
- III. **20th century (Anthropology vs Ethnobotany):** The indigenous knowledge was studied under the umbrella of ethnobotany where the descriptions of the relationship between people and plants were made.
- IV. **The modern era (Late 20th century and now):** The present era where the modern ethnobotanical studies that include scientific analysis and hypothesis testing are being carried out.

#### I. Ancient period to 17th century

Vital information about the uses of plants can be obtained from civilizational countries like India, China, Egypt, Mesopotamia and Greece; their literature, folklores, mythological stories, epic poems like Mahabharata and Ramayana, medicinal treatises, thousands of years old

manuscripts, copper plates, palm leaves and similar other records are the perennial sources of firsthand information. There are three main sources of gathering information, viz. archaeological, sculptural and written records. In India a good number of ancient scriptures were written on various aspects of ethnobotany. For convenience it includes:

### Sacred Literature

Several texts are available in different parts of the world in the form of books and scriptures written on palm and birch leaves. Many of such scriptures are considered as sacred because they are associated with some or the other religion. Such scriptures are predominantly found in India and include *Vedas*, *Upanishdas* (*Aranyakas*), philosophical works and epics like *Ramayana* and *Mahabharata*. There are a number of references of plants in these works, the knowledge being perhaps intuitive. Buddha, Christian and Islamic religions also have religious literature where a large number of plants have been mentioned.

### Lay Literature

The Indian lay literature includes, prose, poetry and dramas of a number of ancient Sanskrit greats like *Kalidasa*, *Magha*, *Bhavabhuti*, etc. Information on plants available in these treatises is incidental and given by way of comparison.

### Technical Literature

Technical literature includes medical work, like *Charaka* and *Susruta Samhitas*, Lexions like *Bhavprakash Nighantu*, *Medininighantu*, *Amarakosa*, etc., encyclopedial work like *Arthasastra* and *Brhatsambita*, etc. Such literature is also available in some other countries.

The **Vedic period**, or **Vedic age** (c. 2500 – c. 500 BCE), is the period in the late Bronze Age and early Iron Age of the history of India when the Vedas were composed in the northern Indian subcontinent, between the end of the urban Indus Valley Civilization and a second urbanization which began in the Central Indo-Gangetic Plains (c. 2000 BCE). The Vedas are liturgical texts which formed the basis of the influential Brahmanical ideology, developed in the Kuru's Kingdom, a tribal union of several Indo-Aryan tribes. The Vedas contain details of life during this period that have been interpreted to be historical and constitute the primary sources for understanding the period. These documents, alongside the corresponding archaeological record, allow for the evolution of the Indo-Aryan and Vedic culture to be traced and inferred. The Vedas were composed and orally transmitted with precision by speakers of an old Indo-Aryan language who had migrated into the north-western regions of the Indian subcontinent early in this period. The Vedic society was patriarchal and matrilineal. Early Indo-Aryans were a Late Bronze Age society centered in the Punjab, organized into tribes rather than kingdoms and primarily sustained by a pastoral way of life.

Around c. 1200–1000 BCE, the *Aryan* culture spread eastward to the fertile western Gangetic plains. Iron tools were used, which allowed for the clearing of forests and the adoption of a more settled, agricultural way of life. The second half of the Vedic period was characterized by the emergence of towns, kingdoms, and a complex social differentiation distinctive to India and the Kuru Kingdom's codification of orthodox sacrificial ritual. During this time, the central Gangetic Plain was dominated by a related but non-Vedic Indo-Aryan culture, of Greater Magadha. The end of the Vedic period witnessed the rise of true cities and large states also called *mahajanapadas* as well as *śramaṇa* movements (including Jainism and Buddhism) which challenged the Vedic orthodoxy. In all four Vedas a good number of plants have been mentioned.

### Ancient scriptures on Medicinal Plants in India

The medicinal use of plants for human beings as well as animals in India dates back to Vedic age, c. 4500-1600 BCE. Some important scriptures written in ancient period are as follows:

- ❖ Rig Veda (c. 4500–1600 BCE) – claims c. 99 medicinal plants
- ❖ Yajurveda (c. 1600–1800 BCE) – listed 82 medicinal plants
- ❖ Sam Veda c. (1200–100 BCE) – various medicinal plants including “Soma”.
- ❖ Atharvaveda (900 BCE) – most important of all Vedas, dealt 288 plants to cure deadly diseases.
- ❖ Brahmans (900–600 BCE) – mentioned 129 medicinal plants
- ❖ Charak Samhita (100–200 BCE) written by Charak, first recorded treatise on Ayurveda based on Agnivesha and Atreya, the great sage. Drugs divided into 50 ‘Vargas’ (groups)
- ❖ Sushruta Samhita (800 BCE) written by Sushruta, concerned with advanced knowledge like surgery, divided drugs, in to 38 ‘Ganas’ (groups)
- ❖ Astanga Hridaya Samhita (7 AD) – written by Vagbhata”, divided Ayurveda into 8 branches
- ❖ Madhavanidan (12 AD) –written by Madhavakar, concerned mainly with diagnosis
- ❖ Sharngadhara Samhita (14 AD) – written by Sharngadhar is a systematic-materia medica.
- ❖ Kalpa sutras (c. 14th AD) – 519 medicinal plants
- ❖ Bhavprakash Nighantu (15 AD) – written by Acharya Bhava Mishra containing more than 600 drugs
- ❖ Rajnighantu (14 AD) – written by Deodas Kashiraj, mentions over 400 herbs
- ❖ Madanpalanighantu (11-13 AD – written by Madanpal, comprises indispensable work on Ayurvedic Materia Medica described medicines into 13 groups (*vargas*).

- ❖ Saligramnighantu (19 AD) – written by Lala Saligram — dealing with 1574 drugs.

### Early written texts (Outside India)

One of the earliest texts describing the uses of plants is the herbal *De Materia Medica* by P. Dioscorides written in 77 AD. Copies of this five-volume pharmacopoeia describing over 600 Mediterranean plants were in use until 1600 AD and it was translated into four other languages (Collins, 2000). It was one of the first written texts to give plant names, lists of synonyms, characteristics, habitat, distribution, medicinal uses, preparations and cures. Religious texts (Moldenke & Moldenke, 1952) such as the *Bible* also describe the use of plants. The *Holy Quran* also mentions several sacred plant species. Overall, describing, recording and communicating uses of plants, irrespective of its form, has been an important endeavor inextricably linked to the survival of people. Some important ancient literature are mentioned below:

### The Egyptian Pharmacopeia

The manuscript 'Eber Papyrus' (dates from about 16th century BCE) is an Egyptian *Materia Medica* and showed the copious use of medicinal plants like poppy, castor oil, squills (*Drimia maritima*), *Aloe*, etc. (Bryan, 1930). The use of garlic (*Allium sativum*) towards problems on blood circulation was discovered by the Egyptians. This is now proved by modern researches that some significant anticoagulant and antithrombotic action is inherent in the plant. Similarly, the Crocus (Autumn crocus, *Colchicum autumnale*) was used to cure gouty-arthritis by the Egyptians and at present the drug colchicine is applied to this same ailment. The folk medicine of Egypt was so rich that the Ebers Papyrus alone contained about 800 prescriptions

### Chinese Pharmacopeia

Two earliest records showing the efficacies of herbal treatment can be traced back to the Chinese pharmacopoeia, the *Pun-Tsao* (written at some time prior to 2500 BCE). It is a compendium on Chinese medicine, comprising 40 volumes containing several thousand prescriptions, 265 drugs including 240 plant products (Hao & Jiang, 2015). The medicinal plants mentioned in the *Pun-Tsao* include the Indian hemp, aconite, opium poppy and croton. The use of *Ephedra* (a gymnosperm having antihistamine property) and ginseng (*Panax ginseng*) can be traced back to ancient Chinese folk medicines. In China, *Ephedra* was used against bronchial asthma and in later years the active principle Ephedrine was isolated from it.

Some important workers who made great contributions in the field of medicinal plants are:

- \* Assyrian & Babylonian pharmacy mentioned- 250 herbs
- \* Hippocrates (460 BCE) - wrote 'Greek medicine' and named 400 'simples'

- \* Theophrastus (370- 287 BCE) wrote 'On the History of Plants' describing over 500 drugs
- \* Dioscorides (60<sup>th</sup> AD) – work published in 1499, mentioned a large number of medicinal plants
- \* Pliny (23rd-79<sup>th</sup> AD) – 'Natural History' – described herbal medicines
- \* Galen (130<sup>th</sup> AD) – wrote about 'galenicals' or vegetable drugs
- \* Rhazes (10<sup>th</sup>AD) – 250 books e.g. "Alhavi Kabeer"
- \* Avicenna (980-1033AD) – founder of Graeco Arabic School of medicine wrote *Canons* and described 719 drugs
- \* Sharif (AlIIdrisi, 1100-1166AD) – Information of medicines contained in *Alaquaqr*
- \* IbneBaitar – 'Alaquaqr' (1197–1248 AD) – described over 1400 drugs

### II. 18-19<sup>th</sup> Century (The Economic Objective)

People often think of migration as a recent phenomenon. However, migration has been a feature of human existence for centuries. Humans have always migrated in groups and as individuals to seek freedom from wars and conflicts, to escape hunger and poverty, to find new economic opportunities and employment, to flee from religious intolerance or political repression, or even to trade and to travel to new places. The historian Robin Cohen (1995) has identified some distinct migration periods or events that have taken place over the last four centuries. When migrants move from one country to another, they carry a new range of skills and perspectives, which nurture technological innovations and stimulate the economic growth. At the same time, increased heterogeneity may undermine social cohesion, create coordination and communication barriers, and adversely affect economic development. The Columbian exchange, also known as the Columbian interchange, named after Christopher Columbus, was the widespread transfer of plants, animals, culture, human populations, technology, diseases, and ideas between the Americas, the Old World, and West Africa in the 15th and 16th centuries. It also relates to European colonization and trade following Christopher Columbus's 1492 voyage (Nunn & Qian, 2010). Invasive species, including communicable diseases, were a by-product of the exchange. The changes in agriculture significantly altered global populations. The most significant immediate effects of the Columbian exchange were the cultural exchanges and the transfer of people (both free and enslaved) between continents. The new contacts among the global population resulted in the circulation of a wide variety of crops and livestock, which supported increase in population in both hemispheres. Initially new infectious diseases caused precipitous decline in the number of indigenous people of the Americas. Traders returned to Europe with maize, potatoes, and tomatoes, which became very important crops in Europe by the 18th century, and later in Asia.

Because of the new trading resulting from the Columbian exchange, several plants native to the Americas have spread around the world, including potatoes, maize, tomatoes, and tobacco (Crosby, 2003). Before 1500, potatoes were not grown outside of South America. By the 18th century, they were cultivated and consumed widely in Europe and had become important crop in both India and North America. Potatoes eventually became an important staple of the diet in much of Europe, contributing to an estimated 25% of the population growth in Afro-Eurasia between 1700 and 1900. Many European rulers, including Frederick the Great of Prussia and Catherine the Great of Russia, encouraged the cultivation of the potato (Nunn & Qian, 2007). Maize and cassava, introduced by the Portuguese from South America in the 16th century gradually replaced sorghum and millet as Africa's most important food crops (Crosby, 2003). Spanish colonizers of the 16th-century introduced new staple crops to Asia from the Americas, including maize and sweet potatoes, and thereby contributed to population growth in Asia (Riley, 2007). On a larger scale, the introduction of potatoes and maize to the old World resulted in caloric and nutritional improvements over previously existing staples throughout the Eurasian landmass (Collingham, 2006) enabling more varied and abundant food production (Nunn & Qian, 2010). Tomatoes, which came to Europe from the New World via Spain, were initially prized in Italy mainly for their ornamental value. But starting in the 19th century, tomato sauces became typical of Neapolitan cuisine and, ultimately, Italian cuisine in general (Crosby, 2003). Coffee (introduced in the Americas in 1720) from Africa and the Middle East and sugarcane (introduced from the Indian subcontinent) from the Spanish West Indies became the main export commodity crops of extensive Latin American plantations. Introduced in India by the Portuguese, chili and potatoes from South America have become an integral part of our cuisine (Riley, 2007). Central to the systematic recording of plant uses, now known as economic botany, was the spread of crops to and from the New World by botanic gardens. Such transfers were facilitated by Kew Gardens, in London, UK. From the 1780s, Kew Gardens received plants, seeds and information from the New World, catalogued them and sent them on to other parts of the world to be planted as crops (Drayton, 2000). This exchange included the coffee, sugar, rubber and nutmeg i.e. *Myristica* (Schiebinger, 2005). The impetus behind these explorations was the economic objective of contributing to the empire and breaking other countries' monopolies over trade.

#### **Invasion of Dutch East India Company**

Hendrik Adriaan van Rheede tot Drakenstein was a military man and a colonial administrator of the Dutch East India Company and naturalist (Lewis, 2012). Between 1669 and 1676 he served as a governor of Dutch Malabar and

employed twenty-five people on his book *Hortus Malabaricus*, describing 740 plants of the Malabar region. As Lord of Mydrecht, he also played a role in the governance of the Cape colonies. Many plants such as the vine *Entada rheedii* are named in his honour. The standard author abbreviation 'Rheede' is used to indicate this person as the author when citing a botanical name. It was published in 12 volumes (1678-1703) and in four languages. The ethno-medical information presented in the work was extracted from palm leaf manuscripts. As many as 255 Rheede elements were used by Linnaeus for description.

#### **III. 20th Century (Anthropology vs Ethnobotany)**

Anthropology is the study of what makes us human. Anthropologists take a broad approach to understanding the many different aspects of the human experience, which we call holism. They consider the past, through archaeology, to see how human groups lived hundreds or thousands of years ago and what was important to them. Since the beginning of 20<sup>th</sup> century anthropology took over and viewed plants as representations of cultural traits (Ford 1994). Interdisciplinary co-operations became the norm, with botanists describing species from a Western science point of view, and anthropologists transcribing the native nomenclature without understanding the indigenous classification behind it. However, the aim of much of what was written was still to discover useful plant products. During the formative period of ethnobotanical studies in the Southwest, Palmer (1871) established a standard for reporting useful plants that continues today. Cushing (1920) wrote a classic ethnobotany from an anthropological perspective. Since these beginnings, single tribal studies and more recently, archaeo-botanical investigations have received much emphasis. Linguistic studies of plant names and their classification have lagged and synthetic summaries and interpretative explanations of plant use are still demanded. Anthropology's unique contribution to Southwestern ethnobotany is relating socially shared plant taxonomies and cultural rules for behaving with plants to explain why certain plants are used and others are ignored.

The idea of ethnobotany was first proposed by the early 20th century botanist John William Harshberger who was an American botanist and specialized in geography, ecology and plant pathology. He taught at University of Pennsylvania for more than 35 years. While Harshberger did perform ethnobotanical research extensively, including in areas such as North Africa, Mexico, Scandinavia, and Pennsylvania it was not until Richard Evans Schultes began his trips into the Amazon that ethnobotany become a more well-known science in many countries (Haut, 1997). Schultes, the eminent Harvard University professor and 20<sup>th</sup> century Father of Ethnobotany, citing his ideals of ecology and human kinship with plants coupled with a cultural sensitivity to the various people under study, and an appreciation for their diverse

spirituality and cosmology (Schultes & Reis, 1995). However, the practice of ethnobotany is thought to have much earlier origin in the first century AD when a Greek physician by the name of Pedanius Dioscorides wrote an extensive botanical text detailing the medical and culinary properties of "over 600 Mediterranean plants" named *De Materia Medica*. Historians note that Dioscorides, while traveling often throughout the Roman Empire, including regions such as Greece, Crete, Egypt and Petra, obtained substantial knowledge about the local plants and their useful properties. European botanical knowledge drastically expanded after the discovery of New World through the exchange of ethnobotanical information between the two continents. This expansion in knowledge can primarily be attributed to the substantial influx of new plants from the Americas, including crops such as potato, peanut, avocado, and tomato. The French explorer Jacques Cartier learned a cure for scurvy (a tea made from the needles of a coniferous tree, likely spruce) from a local Iroquois tribe.

#### Watt's Dictionary

Sir George Watt (1851 – 1930) was a Scottish physician and botanist who worked in India as 'Reporter' on economic botany and during the course of his career in India he compiled a major multivolume work, *The Dictionary of Economic Products of India*, the last volume of which was published in 1893 (George et al., 1889-1896). An abridged edition of his work was also published as the single volume *Commercial Products of India* in 1908. He is honoured in the binomials of several plants named after him. An exhibition of rich collections of economic products was organized in Calcutta (1883-1884) and created awareness to acquire and document the abundant wealth of natural resources in order to exploit it commercially. 'Wealth of India' is a revised and updated form of Watt's Dictionary.

#### First Ethnobotanical Text

Harold "Hal" Colyer Conklin (1926–2016) was an American anthropologist who conducted extensive ethnoecological and linguistic field research in South East Asia (particularly the Philippines) and was a pioneer of ethno-science, documenting indigenous ways of understanding and knowing the world. Conklin's (1954) study of the botanical nomenclature and classification of the Hanunóo (a language/script) in the Philippines, is generally considered as the first ethnobotanical text. As an American anthropologist, Conklin used ethnology, ecology and linguistics to describe the basic indigenous plant name types and taxonomic structures. His work on folk taxonomy was followed later by Bulmer (1974) in Papua New Guinea and Mexico (Berlin et al., 1973).

#### IV. The modern era (Late 20th century and now)

Ethnobotany, as the large number of academic and general interest publications, websites, courses, workshops academic programs and media attention suggest, has experienced an unparalleled period of growth during the

past thirty years. Indeed, within this period, the word "ethnobotany" has moved out of the somewhat esoteric margins of science into the academic and public mainstream. This revitalization of ethnobotany is evident in post-industrial, industrializing and non-industrialized nations alike, suggesting its link to broader structural processes (Alexiades, 2003). There has been not only a recent shift in focus from indigenous societies, but also a change in the methods used to describe these relationships. Having been the domain of anthropology for much of the 20th century, there has been a recent expansion of ethnobotany into different disciplines with interdisciplinary approach.

#### Modern Ethnobotany: A Multidisciplinary Science

Many modern definitions of ethnobotany exist, including those by Ford (1978), Berlin (1992) and Cotton (1996). All describe the relationship between indigenous or traditional people and plants. However, Balick and Cox (1996) go further to state that ethnobotany is 'the study of the interactions of plants and people, including the influence of plants on human culture', thereby, broadening the definition to include the influence plants have on shaping a culture as well as incorporating modern or Western societies, as suggested earlier by Ford (1994). The sub disciplines involved include ethnoecology, ethnozoology, ethnopharmacology, ethnomycology and ethnomedicine. Further, many more new sub-disciplines of ethnobotany have emerged. Now, there has been advancement and the ethnobotanical data can be evaluated by statistical methods, pattern analysis or by mathematical modeling (Salick, 2003). An example of a discipline that provides quantitative methods able to be applied to ethnobotany is ecology (Peters 1996). Early applications identified the non-market benefits of the Amazonian rainforest (Peters et al., 1989), while later applications of this methodology provided inventories, monitoring and finally methods of biodiversity management (McClatchy et al., 2004). A number of ethnobotanical methods and manuals have also been produced, including those of Given and Harris (1994), Martin (1995) and Cotton (1996). Not only is ethnobotany now demonstrating increased scientific rigor, but it continues to develop theories based on this type of research. Berlin's (1992) analysis of folk taxonomies introduced the idea that cultures perceive and name elements of flora and fauna based on a number of defined principles. Moerman (1991) not only described Native American ethnobotany, but also analyzed the numbers of medicinal plants within botanical families and showed that certain plant families are more commonly used for medicines than others. More recently, the cultural importance of plant species has been described quantitatively. One of the ways in which this is achieved is through relative cultural importance (RCI) indices which calculate a per plant value (Hoffman & Gallaher, 2007). The extent to which ethnobotanical knowledge is held and lost is also a feature of modern ethnobotanical studies

(Zent, 2001). Comprehensive ethnobotanical texts include those in Asia (Anderson, 1993; Austin, 2004) the Americas (Boom, 1987; Moerman, 1998), the Pacific (Whistler, 2000; Balick, 2009), Europe (Pardo de Santayana et al., 2010) and Africa (Maundu et al., 2001). For wider, more reliable and scientific application of this knowledge, researchers are continuously subjecting it to a variety of tests through field, laboratory or clinical research. Several qualitative and quantitative methods have also been suggested for evaluating credibility of such traditional knowledge or folk claims as they are often called (Jain, 2004). Modern ethnobotanical approach uses a number of different methods adopted from varied fields including: History, Evolutionary Biology, Agronomy, Forestry, Linguistics, Ecology, Ethnology, Botany, Pharmacology, Geography, Archaeology, Palaeobotany, etc. (Alexiades, 2003). Such is the contribution from different disciplines that sub-disciplines have formed within the wider discipline of ethnobiology that also incorporates ethnobotany. Nowadays the 'Computational Biology' is being used in Ethnobotany, drug discovery and germplasm enhancement. Computational biology sometimes referred to as Bioinformatics is the science of using biological data to develop algorithm and relations among various biological systems. Algorithm is a process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer. Prior to the advent of computational biology, biologists were unable to have access to large amounts of data. Researchers were able to develop analytical methods for interpreting biological information, but were unable to share them quickly among colleagues. Now it has been possible due to use of computational biology. Alcorn (1984, 1995) has discussed how the human relationships with plant resources, i.e. the human, cultural and material uses of plants are largely shaped by history, and by physical and social environments. These relationships cover a very wide canvas, from wild foods, medicines, fibers, fodders, dyes and body ornamentation, etc. to still more important, but less understood areas of the social and religious relationships, like beliefs, faith, taboos, worship and even protection and preservation. It is a very vast area of knowledge. Further, Alcorn (1995) suggested that there are two aims of modern ethnobotanical study.

1. The first is to describe facts about plant use and plant management, and
2. To define, describe and investigate ethnobotanical roles and processes.

Indeed, in recent years there has been a significant shift from compilations of data to greater methodological and theoretical objectivity (Choudhary et al., 2008). Alongside this realignment, there has been a conscious move from implied to stated hypotheses which test inferred inter-relationships by gathering both qualitative and quantitative ethnobotanical data (Phillips & Gentry, 1993). A huge amount of work on several ethnobotanical aspects has been

carried out and continuing in different parts of the world in the past three decades.

#### **The untiring journey of ethnobotany has played a great role in:**

1. Collecting huge data on indigenous knowledge and tribal culture.
2. Exploring new medicinal plants.
3. Germplasm collection and conservation.
4. Micro-Propagation of threatened ethnobotanical plant species.
5. Identification of RET species.
6. New drug discovery through extraction of biochemical compounds
7. Exploration of new edible plants.
8. Exploring plants for material culture and other purposes.
9. Credibility of medicinal plants.
10. IPR issues
11. Employment generation for indigenous/local/poor people.
12. Establishment of Cottage Industries.
13. Biodiversity conservation in Sacred Groves.
14. Socio-economic aspects of indigenous people and strategies for raising their economy.
15. Development of tribal art and culture through exhibitions and trade fairs.

#### **Discussion**

Ethnobotany has travelled a long journey since its birth, i.e. dawn of civilization. The term 'Ethnobotany' may be only 126 years old but it has been practiced by the people of various societies in different parts of the world since time immemorial. In earlier days the focus was on medicinal plants but with the change of time it incorporated several other disciplines. In modern times the face of ethnobotany is entirely different. Now it has crossed the boundaries of tribal areas and entered in urban areas. Through traditional knowledge it was practiced by folk or rural people but now extensive work is going on in modern sophisticated laboratories. The intersection of the factors outlined above has transformed the social, political and economic meanings of traditional environmental knowledge and associated biological resources. It is amidst this transformation that new opportunities and challenges for ethnobotany are shaped. The implicit explicit role of ethnobotanists as mediators between different knowledge systems and social groups has important implications with regards to what, how, for whom, for what and by whom knowledge is collected, represented, disseminated and used. Because our world is increasingly interconnected yet riddled with inequity and conflict, and because the social and political stakes linked to knowledge and its transformations are greater now than before, this aspect of ethnobotany has recently acquired renewed importance. The knowledge of the indigenous people about their bioresources is extensive, and it is said that this knowledge

is more than all their other domains of knowledge put together. Ethnobiology has been used as an organizing focus from which to assess human adaptive responses and human impact on biodiversity. Attention has therefore been directed to the factors that make a species a resource worth utilization and worthy of efforts for conservation. Looking to the changing pattern of ethnobotany, Jain (2018) has rightly pointed out that ethnobotany is not confined only to traditional knowledge, but with great emphasis it also includes indigenous knowledge, anything new which has been created indigenously by the people, may be the rural people, the urban people even today is in realm of ethnobotany. Ethnobotany has given opportunities to work to the people of almost all walks of life. Now it is not restricted to the scholars of biological science alone, but there are great avenues to social scientists and workers of other disciplines also.

Ethnobotany, as the large number of academic and general interest publications, websites, courses, workshops academic programs and media attention suggest, has experienced an unparalleled period of growth in the past twenty years. Indeed, within this period, the word "ethnobotany" has moved out of the somewhat esoteric margins of science into the academic and public mainstream. This revitalization of ethnobotany is evident in post-industrial, industrializing and non-industrialized nations alike such as the Society of Economic Botany, Society of Ethnobiology, Society of Ethnobotanists and the International Society of Ethnobiology have provided more focus to their associated disciplines and encouraged an expansion in research with the creation of scholarly journals; these include the *Journal of Ethnobiology*, *Ethnobotany*, *Ethnobiology Letters* and *Economic Botany*.

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