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Saga of ethnobotanical genesis from ancient to present scenario with special reference to the Darjeeling Himalayas

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Abstract
The New Encyclopedia Britannica defines Ethnobotany as a systematic study of the botanical knowledge of a social group and its use of locally available plants in food, medicine, clothing or religious rituals. Rudimentary drugs derives from plants used in folk medicines have been found to be beneficial in the treatment of many illnesses both physical and mental. The Ethno botany of prehistoric cultures is discovered through examination of ancient writings, pictures, pottery and plant remains in jars or milder heaps (garbage dumps) excavated at archaeological sites. From this information, the agricultural practices and cultural development of the people can be determined. A discussion of human life on this planet would not be complete without a look at the role of plants. A complete record of the many thousands of plant species used for human functioning would fill volumes, yet historians have often tended "to dismiss plants as less than fundamental in history." In recent years, however, there has been a reawakened scientific interest in the fundamental role plants play in many cultures, including medicinal purposes. Why is this so? That is the story of today's ethno botany.

Keywords: Ethnobotany, herbal treatment, traditional medicine, synthetic drugs, anti-inflammatory, aromatic plants

Introduction
The science of ethnobotany draws information from the ambient vegetation and human societies. The ways of perceptions, use and conservation by the traditional cultures are the basic concerns of ethnobotany. J. W. Harshberger (1895) defined the science denoting the uses of plants by the aboriginal people. Later, ethnobotany has been defined by various workers and widened its scope (Robbins *et al.,* 1916; Jones, 1941; Fualks, 1958; Schultes, 1963; Heiser, 1995). Even before Harshberger this science was introduced by Powers (1873) by using a term 'Aboriginal Botany'. Land of India is an amalgam of races, religions, languages, and cultures. It is also rich ethnobotanically and floristically. Today it has 18% of the world's human population and aboriginals of 563 types. India has wide scope for ethnobotanical research for the betterment of mankind [1].

The plants are the life blood of our life, providing not only our basic amenities like fuel, fodder, food, frame works to our houses and other stuffs but also acts as elixir in curing many a malady encountered by us. The tenacious bond between the mankind and vegetal world dates back prior to the dawn of civilization. During Paleolithic era or even before that forest happened to be the largest pharmacy and we used to rely virtually on the goodness of the therapeutical and curative properties of plants for the treatment of various diseases. Those days we took few lessons from the wild animals by the way of observation. 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. 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. Today, owing to our fairly vast knowledge of herbal remedy, we know that because of strong emetic property of *Cynodon dactylon,* it is one of the most reliable plants to de-escalate the pain and uneasiness of stomach. Many herbs of ancient origin, such as species of *Geum* (used by deer against injury), certain grass used by cats to act as emetic and the use of hartworts by does to ease parturition, were obtained by actual observation and experimentation. There must have followed some instances of accidental poisoning or occurrence of psychological drug effect by

use of plants too which they started inquiry into it. These might only be the representative of some of the examples, out of thousands, the way our forefathers might have accumulated and catalogued painstakingly the remedial and curative virtues of plants which have today became the foundation of ethno botany.

Herbal system of medication, being one of the offshoots of alternative system of medicine, is gaining momentum these days because of the side effects shown by the pill popping culture of today's generation. The growing awareness and inclination to use herbal products by a considerable section of people in the west have added more impetus on the science. Ethnomedicine has maintained its popularity in all regions of the developing world and its use is rapidly expanding in the industrialized country [2]. In China traditional herbal preparations account for 30-50% of the total medicinal consumption. In Ghana, Mali, Zambia and Nigeria, the first line of treatment for 60% of children with malaria is the use of herbal medicine. In San Francisco, London and South Africa, 70% of people living with HIV/AIDS use traditional medicine [3]. However, it is advisable that without the sound knowledge of herbal formulation, it may become highly dangerous to prescribe herbal remedies to cure various ailments, so as to avoid accidental poisoning or over dose which may even lead to death.

Vital information about the use of medicinal plants can be obtained from ancient countries like India, China, Egypt, Mesopotamia and Greece; their literature, folk-lores, 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. 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 BC) and in the manuscript of '*Eber Papyrus'* which dates from about 16th century B.C. The medicinal plants mentioned in the *Pun-Tsao* include the Indian hemp, aconite, opium poppy and croton. The use of *Ephedra* (a gymnospermous plant having antihistamine property) and ginseng (*Panax ginseng*) can be traced back to ancient Chinese folk medicine. In China, ephedra was used against bronchial asthma and in later years the active principle Ephedrine was isolated from it [4, 5]. The manuscript '*Eber Papyrus'* showed the copious use of medicinal plants like poppy, castor oil, squills (*Drimia maritima*), aloe etc. 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 colchicines is applied to this same ailment. The folk medicine of Egypt was so rich that the *Ebers Papyrus* alone contained about 800 prescriptions. Another instance of herbal power knowledge of ancient Egypt is evident in the mummification technique [6].

The great Indian epic literatures of *Atharvaveda* (2000 BC), *Rigveda* (3500-1800 BC) and the ancient herbal books written by Charaka and Susruta also give us indepth insights into the therapeutical properties of vegetal world. The medical works, the *Charaka Samhita* (100-500 AD) and the *Susruta* Samhita (200-500 AD) written by Charaka and Susruta respectively are esteemed even today as treasures of literature on indigenous medicine. The latter deals with about 700 drugs, some of these are not indigenous to India. The references to plants in the *Rig Veda* are very brief. More detailed account is available in the *Atharva Veda*. The period of *Rig Veda* is estimated to be between 3500 and 1800 B.C. After the *Vedas*, there is no information on the development of this science in India for a period of about 1000 years [7]. Contemporarily, the various contributions of Bag Bhatta, Vab Misra and Madan Pal enriched the subject more in terms of herbal discoveries as well as to its pharmacognostical properties. The record of the very first Indian medicinal plant is *Soma* being used by Indo-Aryans, however, its correct equivalent nomenclature in the present day is a matter of confusion and conjecture because the plant is referred in literature by their common names and some twenty different plant species have been attributed to this name, varying from plants like *Sarcostemma* (a flowering plant) to *Amanita muscaria* (A fungus), even then many a specialist today presumes it to be *Ephedra pachyclade* [8]. The ephedra despite having intoxicating properties is also regarded as a brain tonic, thus qualified to be an intellect booster; the beverage is divine which purifies, inspires joys and is regarded as a water of life giving health and immortality. The Indo-Aryans used this herb for sacrificial purposes and its juice is described in the ancient Aryan literature as a stimulating beverage.

Similarly, the story by which the Chalmogra (oil) is used from the plant *Hydnocarpus kurzi* (King) Warb. to cure leprosy is also very interesting. In the mid 19th century, the residents of Hawaiian Islands were devastated by the infection of *Mycobacterium leprae*, which is the known causal organism for the disease also called Hansen's disease or leprosy. During those days, the plant *Hydnocarpus kurzi* (Chalmogra) was brought to the islands, where 14 months trial of intravenous injection of chalmogra oil was conducted on the infected patients. The treatment showed the astonishingly positive results, wherein half of the patients recovered from the grip of the disease [9]. In India the oil is used as a massage. Since then more and more plants found entry into native medicine, taking the number of Indian medicinal herbs to about 1500[7]. Some of these medicinal plants have also been featured on Indian postage stamps. The first set of stamps showing medicinal plants came out in 1997. The set had four stamps showing four different medicinal plants - Tulsi (*Ocimu m sanctum*), Haridra (*Curcuma longa*), Sarpagandha (*Rauvolfia serpentina*), and Ghritkumari (*Aloe barbadensis*).

Undoubtedly, India has a very long socio-cultural history and heritage. The instinctive knowledge about the medicinal uses of native plants was preserved by the local communities throughout India. This indigenous knowledge was older than the Ayurveda. The 'Sanskritisation' or 'Refinement' pushes men away from such Un-Sanskritic Practices of following instincts (Manilal, 2007). The Indian scene then changed after the European influx. The western idea about 'Science' in general, has a great impact on this kind of 'Instinctive knowledge' or 'primary perception', although it was taught by the Nature. Malabar region (present-day Kerala state) of India was first trodden by the western societies. Recorded history of plants really started thence [1].

Acosta (1578), the physician at the Royal Hospital of Cochin (Kerala) published a book *"Tractado de las drogas y medicinas de las Indias Orientalis"* and also worked on 50 Indian medicinal plants from Malabar region. He published two books written in plain Latin and French languages from Buros (Spain) in a single volume in the year 1593. These books raised great commercial interest in Europe.

Van Rheede, the compiler of '*Hortus Malabaricus'* (1678-1693) gave an excellent and accurate introduction of Malabar,

its people and their customs, especially the virtues of the medicinal plants. The medicinal uses of the plants described in it are hailed from the 'Family Books' of the Collatt Vaidyas, ltty Achuden being one of them. These family books are lost and not extant today (Manilal, 2007). Hortus Malabaricus is thus the only record in existence. The system of medicine documented in it is certainly different from and much older than Ayurveda (Manilal, 2007). This is just a one of the facts in the form of ltty Achuden, revealed. How many facts still remained unearthed from Indian Culture? Ezhavas community in Kerala integrated the folk medicinal knowledge with Ayurveda and produced publications in the regional language. Few of them are: 'Yogamritham' by Uppot Kannan, 'Oushadhi Nighantu' by Thayyil Kumaran Krishan, and 'Keralaramam' by ltty Achuden, an unpublished script.

Although the concept and definition of the science of 'Ethnobotany' was cleared respectively by Powers (1873) and Harshberger (1875), the elements of this science appeared in India even before. Garcia da Orta (1563) published a book '*Coloquios dos simples e drogas e cusas medicinas da India*'. It informed about 50 common taxa of medicinal significance and other utilities as gathered around Goa and in Malabar. Interestingly, it is in the form of a dialogue between the author and Spanish fictitious Doctor Rauno. This is truly the first book in print form on Indian plant species especially with line drawings. It is not only a milestone in the history of 'Ethno botany' or 'Botany', but also a landmark for the science of Pharmacognosy in Indian context.

The science of Ethnobotany began taking shape during British regime. They surveyed wild and cultivated plants as a part of their floristic /botanical studies. William Roxburgh (1832), during his floristic investigations particularly in South India, noted medicinal uses of herbs, apart from their botanical identification and vernacular names. Since 1873, Sir George Watt studied economically important plant species especially in Manipur and the adjacent Burma (presently Myanmar) region for about a decade. He was in-charge of an exhibition on 'Indian Economic Products' which were obtained from all over the country. It was sponsored by the then Government of Bengal (Presently West Bengal and Bangladesh). They were exhibited in the Indian Museum (ISIM), Kolkata (then Calcutta). He published 'Dictionary of the Economic Products of India' (1889-1896) and "The Commercial Products of India" (1908). In the former Dictionary, he provided nearly 3000 local names of plant products and their uses as obtained from various regions of India. He also equated these names with important Indian languages and even tribal dialects. He also paid attention for the sacred plants. His works is not only a monumental one, but also reflects true "Ethnobotany" and indigenous knowledge of Indian Societies. Later, Bodding (1925, 1927, and 1940) published medicines used by Santal tribe and other useful plants. These were published in Memoirs of Asiatic Society of Bengal. This work was revived by Jain and Tarafder (1970) after Indian Independence.

From the 16th century onwards foreign workers took a firm rein in active herbal study. Thomas Rives, Odardo Verbosa, Cristobal daCosta and Garcia daOrta are the names which are most prominent at these early stages. After this, the 18th and 19th centuries heralded some of the most outstanding contributions based on researches on modern lines which practically forged a strong foundation for later year's investigations. Out of the many, some of the major works may be accredited to Ainslie, 1813 and O'Shaughnessy and Wallich**,** 1844. After the end of 18th century the Indian investigators saw two major works in *Hindu Materia Medica* (Dutt, 1870) and *Indigenous Drugs of India* (Dey, 1883). Also the works like *Vegetable Materia Medica of India,* (Dymock, 1883) and *Pharmacographia Indica* (Dymock *et al.,* 1890-93) and *Economic Products of North-Western Frontier Provinces* (Atkinson, 1882) may be mentioned at this point. The last outstanding work of the century came in the form of Sir George Watt's *Dictionary of the Economic Products of India*, between 1889- 96.

The best known treatise to come up at the beginning of century is the four-volume magnum opus of Kirtikar and Basu, *Indian Medicinal Plants* (1918). Nadkarni's work *Indian Meteria medica* which came up in 1926 brought up an exhaustive treatment on the properties of medicinal plants of the sub-continent. A few major works followed after this and finally *The Indian Pharmacopoeia* (IP) was scored in 1955.

Pioneers in the Field of Ethno botany and Medicine

The Greeks and Romans during 450-300 BC had an erudite wisdom vis-à-vis the utilization of therapeutical herbs and this fact had been proved by the extensive works carried out by some of the most revered names associated with the herbal treatment like Hippocrates, Aristotle, Theophrastus, Pliny the Elder, Dioscorides and Galan. Their works were so precise and succinct that they enumerated herbal medicine with their names along with a description of each plant, illustrations, their putative healing properties and also complex descriptions for the formulation and preparation of medicines. Hippocrates, the 'Father of Medicine' and the person to bring up more than 200 plants in connection with drugs and medicine, was the first to attempt a scientific explanation for diseases. His influence remains today in the Hippocratic Oath taken by young doctors upon their graduation from medical school.

Dioscorides (he is being honoured by giving his name to the plant belonging to the genus *Dioscorea*) treatise on medicinal plants *De Materia Medica* remained the supreme authority for over 16th centuries, during which the manuscript was laboriously copied and recopied with few additions. The *tour de force* of Dioscorides contains an account of more than 600 species of plants of herbal character, with illustrations, and most importantly, the medicinal preparations of the plants. This is further supplemented by the various effects of plants on human body-beneficial as well as possible side-effects. As to these pioneering efforts in drug preparation from the plants Dioscorides is often regarded as the founder of pharmacognosy. The names of some herbs, such as *Anemone* and *Aloe*, can be traced back to him

Similarly, the work of Aristotle, Galen and even Pliny were copied and handed down with increasing inaccuracies. During the Dark Ages (A.D. 400-1000) few new ideas were added. During the Middle Ages (A.D. 1000-1500) also little significant botanical progress was made. Had biology progressed steadily from the time of Aristotle, there probably would have been no great plague (one plague epidemic during 1347 and 1350 killed 60 million people in Europe, Asia and Africa) and small pox epidemics during the Middle Ages[8]. The realization of the existence of 'active principles' in plants, termed as 'quintessence' by Paracelsus, during the 14th century was a great step towards understanding the herbs in a better perspective. The active principles in plants vary at different growth stages, climatic and edaphic conditions, harvesting techniques, storage and mode of extraction etc. Thus, Theophrastus in his 'Enquiry into Plants' wrote, "He who would obtain peony root (*Paeonia lactiflora*) Pall. was advised to dig it up at night because, if he did the deed in day time and was observed by wood picker he risked the loss of his eye-

sight". The work of Theophrastus, *De Historia Plantarum* (History of Plants), which in all essence a pure botanical treatise, is considered the first ever attempt towards a scientific order in the field. His mention of ferns as being used as an anthelmintic was quite a novel thing for the day.

At the beginning of the 16th century, many a work of considerable ingenuity were published with regard to medicinal plants, such as those of Brunfels (1530), Bock (1539), Fuchs (1542), Cordus (1561) and L'obel (1576). Although all these literary works were superb in their own rights and much better than the works carried out previously but still then their inclination towards superstition and myths cannot be overruled like the '*Doctrine of Signatures*' advocated by an eccentric genius Paracelsus (1493-1541), according to which all the plants possessed certain sign given by God, which indicated their usefulness in treating diseases of similarly shaped organs in human body. For example, pomegranate seeds which resemble human teeth used for dental disease, walnut with numerous invaginations and convolutions for brain, mandrake plant resembling torso and the lower limbs of a human body were believed to be quite efficacious for various human maladies. However, later in 1889 it was found to contain potent alkaloids, hyoscyamine, hyoscine and mandragorine in its root making it perhaps the true anaesthesis of those eras. The same plant had occupied a prominent position in the work of Shakespeare- This plant *Mandragora canlescence* Clark is associated with the charm and superstition, despite being an important vegetable drug. The chemicals possess aphrodisiac and pain relieving properties when its root decoction is ingested with wine or boiling water. It is soporific like poppy- To quote from Shakespeare (Othello, Act III, Sc iii, 335 11) [10]:

'Not poppy nor mandragora
Nor all the drousy syrups of this world
Shall ever medicine there to that sweet sleep'.

Quoting from T. J. Williams, 'Mandrake root resembles with the human body and it is used as a charm. It carries by women of Eastern Europe as a charm against sterility'[10]. So, there are hundreds of stories of medicinal plants being used superstitiously both in Indian and European literary works in the bygone eras and it is indeed true that herbal remedies are in practice and subjected to detail study since time immemorial and practically there is not much difference in the value of the medicinal herbs and the method of treatment used by the people from those mentioned in the Ayurvedic, the Unani, the Allopathic and the Homeopathic literature.

Patil, 2012, reviewed the science of Indian ethno botany quite elaborately to initiate debate among Indian ethnobotanists and to chalk out justifiable strategy for India. He had endeavoured to disclose stages of development of Indian ethno botany since ancient times to date.

Ethnobotanical Research after Indian Independence[1]

As an organized natural science, ethno botany in India is rather young, just about six decades old. It got considerable attention since middle of the 20th century. Dr. E. K. Janaki Ammal as an official programme in the Economic Botany Section of Botanical Survey of India (B.S.I.) since its very inception in 1954, she studied subsistence food plants of certain tribal people especially of South India (Janaki Ammal, 1956). She explored better prospects of Dioscoreas. She lit the lamp of 'Scientific Indian Ethno botany' by creating an 'Ethnobotanical Section' at the Central Botanical Laboratory, Botanical Survey of India (BSI), Allahabad in 1960. She did loud thinking and a wish of her publications, which has been fulfilled later by Indian ethnobotanists. Dr. S. K. Jain (former Director, B.S.I., India) made intensive studies in Central India (Jain, 1963 a, b, c, d). He impressed the Indian Scientists from different disciplines. He streamlined this science and trained many students. He also stressed the need of organized field studies in different parts of India.

Sitholey (1976) described some plants from archeological materials. His work dealt with about 40 plant representations. Vishnu Mittre (1989) and Saraswat (1993) reviewed archaeobotanical researches giving impression that ancient Indian plants, wheat and rice, were introduced in pre-Harappan times (Sudhir Chandra, 1996). Many institutions of India are contributing in their own way to ethno botany, to cite few, Botanical Survey of India. Central Council for Research in Ayurveda, Siddha and Unani Medicine, NBRI, National Bureau of Plant Genetic Resources, Birbal Sahani Institute of Paleobotany, Central Institute of Medicinal and Aromatic Plants, etc., besides colleges Universities, societies and associations of particular mention, society of Ethnobotanists (SEB) established during 1980 is providing a common platform for training courses and organizing seminars, symposia, etc.

Records of indigenous knowledge about plants in India can be traced back to the times of Vedas. Prior to 20th century, although it has been available in written form, there are no records of evaluation of literature of indigenous or ethnobotanical knowledge. This is so because India was ruled for many centuries by foreign invaders/rulers that diligently or negligently paid no attention on such scientific matters, Jain *et al*., (1984) brought out 'Bibliography of Ethno botany' for the first time on Indian Contributions. It is arranged alphabetically encompassing, literature on economic botany, ethno botany and floristic works mentioning local plant uses published in and outside India. They excluded publications from purely anthropological works, botanical works, ethnographies, experimental works, phytochemical literature and literature not published in English. They included literature disseminated at the deliberations of some important conferences. Later, Sudhir Chandra (1996) made passing reference and remarks on: (i) Bibliography on Pharmacognosy of Medicinal plants by Roma Mitra (1985) which included about 1200 references, (ii) Hearbal drugs in Indian Pharmaceutical Industry by S. K. Kapoor and Roma Mitra, and Virmani's Directory of Crude Drugs and Aromatic Plant Dealers (1982), which involved tribals for collection from remote and inaccessible areas. Jain and Srivastava (1959) published Dictionary of Ethnoveterinary Plants of India and gave an account of 836 species.

A book entitled "Indian Materia Medica" written by Dr. K. M. Nadkani and revised and enlarged his father's edition by A. K. Nadkarni in 1976. This book contains Index list of 2000 Indian plants and drug from which mother tinctures and extracts etc. are prepared according to homeopathic system of medicine. The Indian Materia Medica describes the plants in different headings like: Name of plants in different Indian languages, habitat, and constituents. Resurgences of Ethnobotanical research especially after 1985 culminated into some bibliographies covering some regions/states or journal-wise have appeared. They are presented briefly in the following:

I. Jain and Srivastav (2001) gave graphic review of Indian ethnobotanical literature of about 1250 publications during 1982-2000.

II. Roma Mitra (2001) gave 88 references on Indian ethno botany.

III. Roma Mitra (2002) also gave a list of 91 references for the period of 2001 and 2002.
IV. Nath and Begum (1998) enlisted 100 references for North Eastern India of which 23 were not included by Jain (1984).
V. Roma Mitra (1997) provided a list of 67 references published during 1996 and 1997.
VI. Roma Mitra (1998) also provided bibliography of some 87 references for the period of 1996 to 1998.
VII. Roma Mitra (1999) again enlisted 97 references for years 1998-1999.
VIII. Wahal and Roma Mitra (2003) enlisted references for the period 2002-2003.
IX. Wahal (2004) again enlisted references for the period 2003-2004.
X. Wahal (2005) provided a list of 91 references for the period 2004-2005.
During 1950-1984 about 1000 research papers have been published (Jain *et al.,* 1984). Now the number has reached to 1600 (*cf.* Jain, 2001). As far as books are concerned about 50 books are published during the same period. In last two decades over 300 books have been published (Jain and Srivastava, 2001). There are few more additions by Patil and Patil (2006), Pawar and Patil (2008), Patil *et al.* (2011), John (2008) and few others. The books pertain to some district as a whole, tribes, region or states or as additional series of journals covering entire country, Asian continent or entire world. The latter ones contain ethnobotanical data of India and also published from India.
Following are the aspects of ethnobotanical studies:

1. Ethnomedicine: includes a) Disease-specific; b) Group of diseases
2. Plant or Plant Group Specific: includes: a) Species-Specific b) Plant family-Specific c) Tribal/Ethnic Society d) Plant Group
3. Geographical Area Specific
4. Contact Therapy or Rosaries
5. Medicine for Livestock
6. In the Perspective of Doctrine of Signature
7. In View of Other Systems of Medicine
8. Plant Part-Specific
9. Scientific Screening of Ethnomedicine
10. Cross-Cultural Comparitive Study of Ethnomedicine
11. Ethnomedicinal Drugs Sold by Herbal Vendors
12. Herbarium as Information for Ethnomedicine
13. Exotic Plants
14. Spices as Medicine
15. Aromatherapy
16. Tattooing Therapy
17. Horopathy
18. Old lead-New Drug
19. Food Sources: This category may include: A. Non-Fungal Food; B. Fungal Food.
20. Miscellaneous Uses: Dyes, Fish-poison, Oils, Fibres etc.
21. Drinks, Beverages/Wine, etc
22. General Ethno botany
23. Ethno botany from Literature
24. Ethno botany from Vernacular Plant Names and Ethnotaxonoy
25. Ethno botany from Socio-religious and Cultural Events

Ethnobotanical Works Carried Out in Darjeeling and Sikkim

Historically, Darjeeling was once a part of Sikkim and hence it is customary among authors to include the Darjeeling hills while preparing any book or write-up on Sikkim or include Sikkim while writing books on Darjeeling and hence making them mutually inclusive.

The use of plants as a means to abate certain ailments is an age-old practice throughout the world and the hills of Sikkim and Darjeeling are no exceptions. The practice of herbal medicine in the region has been gradually nurtured since time immemorial and brought up to present scenario with still more additions. Located far from civilization and almost land-locked, the life saving herbs from the wild provided the only refuse during emergency and trauma. Out of the primitive peoples' diligent trial and error, a horde of plants having potent remedial action have come up with proper identification which are still prescribed faithfully by the herbalists after several centuries.
After the exhaustive floristic work on the Sikkim Himalaya was made by Sir J. D. Hooker during 1871-97, a spattering few minor work followed in its wake. The most comprehensive work had to wait for many years which came in the form of 'Common Medicinal Plants of Darjeeling and Sikkim Himalaya' by Biswas (1956). Those days publications on vegetal remedies were littered with short communicated papers without in-depth information into the subject nevertheless, these minor papers provided a good data on ethnobotanical information. However, in terms of plantation of medicinal plants much has been done in Darjeeling and Sikkim Darjeeling hill with its unique agro-climatic conditions attracted many explorers with botanical interest like Sir J. D. Hooker, Professor Hirosiara, and Dr. D. Anderson and in 1864 Cinchona Plantation was established in Mungpoo (Rai 2003). The plantation these days is run under the aegis of the Directorate of Cinchona and other Medicinal Plants (DCOMP or DCMP), Government of West Bengal. DCOMP which was established nearly 150 years back conducts researches on different types of commercial medicinal plants.
Rai *et al*. (1981) investigated the far flung villages of Darjeeling and Sikkim wherein they recorded and studied 48 medicinal, 40 edible, 32 ornamental and 19 plants of other ethnic uses by different ethnic communities of the locality.
Yonzone and Mandal, (1982) made a report on the ethno botanical survey in Kalimpong and Darjeeling district in West Bengal where they have mentioned the use of 17 plants used by local ethnic community and accounted a list of medicinal plants of Darjeeling district.
Lama (1989) made a brief report on the use of 20 different plants as ethno medicine in Sukhe Pokhari region of Darjeeling district. Eigner and Scholz (?) studied food habit of Nepalese and specially mentioned the role of Asafoetida (*Ferula narthex*; *Hing* in Nepali) and Turmeric (*Curcuma longa*; Haldi in Nepali).
Over 400 plants possessing therapeutic properties had been recorded from the Darjeeling hills (Srivastava and Kapaki, 1990).
Thapa and Chhetri (1993) made an ethno botanical Survey in Sikkim Hill mentioning uses of plants as medicine and other purposes.
The groups of lichens which are of medicinal value are also available in the region (*Parmelia*, *Usnea* and *Ramalina*) but the local usage is not known. Over the medicinal plants of the region, it is learnt that, many persona and organizations are working from past several years but so far comprehensive writings have seldom appeared over the regional medicinal plants (Rai and Sharma, 1994).
Stapleton (1994) highlighted the existing scanty knowledge of bamboo that prevailed not only in Bhutan but also in the Darjeeling hills. The publication formed a frame work within

which a much more comprehensive account could be written by local taxonomists. Even though the work was written in the context of Bhutan, the same is highly helpful and indispensible to draw inferences for the workers conducting research on bamboos in the Darjeeling hills and Sikkim, as because almost all the species enumerated in the work were mentioned not only in 'Dzonkha' (language spoken in Bhutan) but in Nepali as well, thus, making the positive identity of various species of bamboo in the field easy. The publication included most of the more common species of bamboo from Central Bhutan wherein 14 different genera ranging from *Dendrocalamus, Bambusa, Borinda, Cephalostachyum and Teinostachyum, Ampelocalamus, Thamnocalamus, Drepanostachyum, Himalayacalamus, Chimonobambusa, Melocanna, Pseudostachyum, Neomicrocalamus, Yushania* and *Arundinaria* were studied and identified in details.

Rai and Sharma (1994) reported the vital topics like background of Sikkim/Darjeeling Himalayas, herbal practices of the region, government/voluntaries bodies involved in conservation and cultivation of native/ exotic medicinal plants, enumerations, methods of harvesting and marketing, cultivation potentiality, extraction procedure, environmental implications and future strategy.

In another development, a project design workshop on 'Cultivation of Medicinal Plants and Orchids in Sikkim' was organized during 21-22 October, 1994 at Gangtok to evolve a strategy for planning and development of these resources. The papers and deliberations of the workshop are compiled in the proceeding publication entitled 'Cultivation of Medicinal Plants and Orchids in Sikkim Himalaya', 1995, (Editors: R.C. Sundriyal and Eklabya Sharma). This reportage was brought up in a view to seal up the gap rendered by the lack of research work carried out in the field of medicinal plants and orchids of the region.

Bhujel (1996) reported the dicotyledonous floras of Darjeeling district in West Bengal.

Mukhopadhyay *et al*. (1996) reported the therapeutic use of the fruit juice of the indigenous species of *Citrus aurantium* (sour orange) locally called *Kali jyamir* in Nepali against the treatment of nutritional anemia which is clinically confirmed by CDRS (Citrus Dieback Research Laboratory, Kalimpong) during 1995-97. Efficient local physician, Late Dr. S. B. Rai clinically confirmed that the fruit juice of sour orange helps to increase the number counts of red blood cell (RBC).

The Directorate of Forest, Government of West Bengal (Anonymous, 1998), has published a bulletin containing 113 medicinal plants of Darjeeling Hill.

Rai *et al.* (1998) published a research report in the Journal Hill Res.

Rai and Bhujel, (1999) highlighted some less known ethnomedicinal plants from the Darjeeling Himalaya.

Rai *et al*. (2000) reported conservation trend of four different species of high value medicinal plants in Sikkim.

Santra and Roy (2002) attempts to understand the value of NTFR (Non Tiber Forest Resource) for the sustainable life style maintenance of forest dwellers of the lower hills and the terai region of northern part of West Bengal which had either medicinal or food values rather than other types of utility. A descriptive enumeration in the work provided the account of 148 species of vascular plants with NTFP (Non-timbers Forest Products) values which are used predominantly by Nepali and Adivasis (Rava, Santals, Uraon etc).

Rai and Bhujel (2002) reported 'Ethnic uses of some monocotyledonous plants in the Darjeeling Himalayan region' with reference to plant diversity.

Sharma (2002) investigated the ethno botany of Hee-Bermeok (a place in West Sikkim) with special reference to Limbu community where he had mentioned 32 medicinal plants used by them in rural health care system, 28 plants used in different rituals, 11 plants needed during marriage, 29 plants during death rite and 17 plants in day to day life.

Gurung (2002) described uses of 424 medicinal plants used by different tribes of Sikkim with its conservation.

Thapa (2003) enumerated list of 200 medicinal plants of which 30 plants have been listed as the possible cash crops in Sikkim Himalaya where medicinal plant is the main forest generated resource.

Maity, *et al*. (2004) reported the folk uses of some medicinal plants from North Sikkim which emphasized on the rich traditional knowledge exhibited by the tribal of North Sikkim vis-à-vis utilization of plant and plant parts for the treatment of some common maladies. The study dealt with the medicinal uses of 15 types of tubers, rhizomes or roots used by Lepcha, Nepalese and Bhutias of North Sikkim.

Chhetri (2004) documented 37 herbal remedies used as antipyretic agents by the traditional healers of the Darjeeling Himalayas. The documentation was done in sequence of serial number, botanical names, families, local names in Nepali, voucher specimen number followed by plant parts used and mode of administration (whether decoction, extract, juice or infusion).

Tamsang (2004) reported Lepchas of Darjeeling and Sikkim as good ethnobotanists and expert herbalists who knew the cure for all the maladies. But due to reclusiveness, superstition, lack of clear and systematic publications and dependence only on oral enumeration of medicinal plants used by the Lepchas, the primitive system of herbal practice is on the verge of extinction.

Hussain and Horde (2005) dealt with certain indigenous medicinal plants among the people of the Sikkim Himalaya (Eastern Himalaya) which includes the entire state of Sikkim and adjoining hill district of West Bengal. The study highlighted the use of 28 plant species belonging to 26 genera and 19 families as herbal medicine in the treatment of various ailments. Considering the growing demands for raw material of medicinal plants by the pharmaceutical companies and their depleting resource base due to unscientific gathering from the wild, the investigation emphasized the utmost necessity to take up *ex-situ* cultivation.

Chhetri, *et al*. (2005) reported 281 species of plants belonging to 229 genera and 108 families which were used in the Darjeeling Himalayan region in folk medicine. The study revealed that about 58 % of the plant showing hitherto unreported uses and 14 % of them under the different categories of threat status thus emphasizing on the domestication of high valued medicinal plants of the region.

A vernacular publication of Pokhrel (2006) emphasized on the herbal medicinal culture and Cinchona plantation at Rongo and Gairi Bans areas of the Darjeeling hills. Similarly, Chhetri, (2006), took up a serious task of putting tit bits of history more specifically of Rango, Dalgaon and Gairibans and the Cinchona Directorate as a whole.

Pradhan and Badola (2008) documented 118 medicinal plant species used ethnomedicinal by Lepcha tribe of Dzongu Valley, bordering Khangchendzonga Biosphere reserve in North Sikkim. The work distributed the plants across 71 families and 108 genera and was found to be used for treating 66 ailments; of which 36 species were used to treat stomach related disorders and 23 species were reported to be used for curing superficial wounds, cuts, sprains and dislocations.

Bantawa and Rai (2009) studied 41 ethnomedicinal plants used by traditional practioners, *Jhankri*, *Bijuwa* and *Phedangma* in the Darjeeling Himalayas; the investigation revealed that the traditional knowledge with regard to treatment of disease was fast vanishing due to lack of proper documentation of herbal treatment by these faith healers.

Bharati and Sharma (2009) studied the ethno-veterinary uses of plant resources of Sikkim, wherein they dealt with 19 plants belonging to 18 families having 24 different ethno-veterinary uses.

Sarkar and Das (2010) studied ethnobotanical formulation in treating jaundice by Meche tribe in duars of West Bengal, wherein they studied 10 different types of formulations using 10 different plant species. Apart from plants, the study also showed the utilization of animal products like hen's eggs, curds, milk and candy to prepare the formulation.

Tamsang (2010) compiled the list of trees, shrubs and climbers which are native to Darjeeling and Sikkim where numerous floral enumerations were made in native Lepcha and Nepali language with their botanical/Latin equivalents along with the call a spade a spade botanical description of the plants with colorful illustrations. The work also mentioned the name of famous botanist, naturalist and geographer, Sir J. D. Hooker who travelled lengths and breadth of Darjeeling and Sikkim collecting wild floras in 1848-1849 who hired Lepchas of Darjeeling to collect plants because Hooker thought the Lepcha names of the plants were the most reliable.

Pal and Palit (2011) reported living style, traditional utensils, food, architecture, costume, ethno-musical instruments, birth and death rites along with 44 ethnomedicinal plants (bearing their botanical names, family, local names in Nepali and Lepcha, and disease cured and related uses) which are used for curing 62 different ailments by the Lepcha tribe of the North Sikkim. Elaborate descriptions of the Lepcha musical instruments were also provided in the study; wherein name of the musical instrument in Lepcha, materials used for making such instruments and their measurements in length and diameter were provided as well.

Saha *et al*. (2011) conducted a survey on ethnomedicinal plants of the Darjeeling hills for their anti-microbial and anti-oxidant activities. A total of 78 plants used medicinally for treating various maladies were studied under the aegis of CSIR-sponsored project. They concluded in the study that the ethno-pharmacological approach was useful in guiding the discovery of pharmacologically valued plants which were traditionally used for treating various ailments.

Yonzone *et al*. (2012) studied 25 plant species belonging to 24 genera and 21 families with their therapeutic values against different diseases occurring in the Darjeeling hills; of these, 12 species were herbs, 7 shrubs and 6 were trees and herbs were found to be more useful than the shrubs and trees and a single species was used for more than one purpose.

Yonzone *et al*. (2012) studied the potentiality of *Kaempferia rotunds* as herbal by the local inhabitants for the treatment of bone fracture, sprain and joint dislocation. They observed that due to hardship of the terrain and financial bottle neck, natives rely on this magical herb for the treatment of aforesaid conditions rather than modern medicines.

Yonzone *et al.* (2012) studied genetic resources, current ecological status and altitude wise distribution of medicinal plants of the Darjeeling Himalaya of West Bengal. The investigation emphasized on the study, classification and prevalence of the herbal floras according to climatic requirements, thus, enumerating 196 herbal floras with threat status categories as acknowledged by the International Union for Conservation of Nature and Natural resources (IUCN).

Yonzone *et al.* (2012) studied the botanical description and present ecological status of *Agrostophyllum*, a less known epiphytic orchid species of the Darjeeling Himalaya of India. The attempt was the first of its kind to correct the taxonomic identification, so as to workout universally accepted botanical names with ecological status, voucher specimen numbers, habitat, altitudinal ranges, phenology and local and general distribution of the same species in the region.

Yonzone (2012) (unpublished), studied taxonomic description, medicinal and ethnobotanical uses of *Geodorum densiflorum* which is a terrestrial orchid species.

Yonzone *et al.* (2012) studied the ethno medicinal and aromatic plant diversity and resources of the Darjeeling district, enumerating 84 plant species. The investigation enlisted the inventories of plants that were facing high risk of extinction due to ignorance, indiscriminate collection, forest fire, landslides, urbanization, construction of dams, change in lifestyle of native tribes and clearing of forests for agricultural lands and other purposes.

Subba (2012) illustrated succinctly the local plants used by native Lepcha people of Darjeeling to cure various ailments along with the plants used for veterinary medicines.

Rai *et al.* (2013) studied 57 plant species belonging to 55 genera with their medicinal values against various diseases found in the Darjeeling hills. The work accentuated on folk-lores, superstitions, traditions, various rituals, wearing of amulets, witchcraft and chanting of mantras connected with the healing of diseases, warding off the influence of evil spirits, demons, bokshi, mata, ancestral spirit, bhut, chudel, evil eyes and changing of fortunes in one's favour- all of which still practiced indulgently and religiously by the aborigines of the eastern Himalayan Darjeeling.

Dikshit *et al.* (2014) reported four ethno medicinally important angiospermic phyto-parasites viz. *Viscum album, V. articulatum, Cuscuta reflexa* and *Dendrophthoe falcate* found in the Darjeeling Himalayas; enumerations were made with their local names, Latin names, family, habit, active principles, altitudinal range, distribution and medicinal properties. The study showed that these phyto-parasites were used for various purposes by the native tribes like, for the treatment of enlargement of spleen, wounds, ear diseases, asthma, tumours, jaundice, headache, rheumatism, itches, ulcer, epilepsy, biliousness, cancers and also as laxative, cardio tonic, and aphrodisiac.

Dikshit *et al.* (2014) studied the distribution of *Ganoderma lucidum* (Kane Chau in Nepali) in the Darjeeling Himalayas and its phyto-parasitic and therapeutic importance. The study revealed that the fungus mixed with coconut oil was used by the local people ethno medicinally for the treatment of ear infection with oozing pus and blood (otalgia). The finding emphasized on the association of the fungus with a specific host plant *Schima wallichii* (Chilaune) and was observed that the fungus growing only on the trunk of this tree was used for the treatment of above mentioned disease by the locals; the reason behind this was still unknown and was concluded as the matter of future research.

Dikshit (2014) provided pen and picture portraits or character studies of the more common, important and interesting trees, shrubs, climbers and bamboos found in the Eastern Himalaya Darjeeling region with their ethno botanical uses. The investigation included the enumeration and utilization of 444 plant species belonging to 307 genera and 118 families.

As far as the ethnic food habits of the native tribes of Darjeeling and Sikkim are concerned, many a pioneering work

had been carried out by various workers:

Tamang *et al*. (1996) studied various types of indigenous food beverages commonly prepared and consumed by ethnic communities of the Darjeeling hills and Sikkim; investigation revealed that *Kodo ko jaanr*, *makai ko jaanr* and distilled part of fermented starchy materials called *Raksi* as most important alcoholic food beverages of the region and were consumed as a part of entertainment and socio-cultural practice which were produced by using traditionally cultured amylolytic mixed inocula called *Marcha* or *Murcha*.

Tamang *et al.* (2000) identified the enzymatic profiles of the predominant lactic acid bacteria (LAB) isolated from soft variety *churpi*, a traditional cheese product of the Sikkim Himalaya. The paper was the first report on the microbial population and predominant LAB of two soft varieties (mild and strong flavoured) of *churpi*.

Tamang *et al*. (2002) investigated the phylogenetic analysis of *Bacillus* strains isolated from fermented soya bean foods of Asia like *Kinema* (a whole soyabean, non-salty fermented food with sticky texture, gray tan in colour and a characteristic flavor eaten as side -dish in the Eastern Himalayan regions of the Darjeeling hills, Sikkim, Nepal and Bhutan); *Chungkokjang* (a fermented soyabean paste, consumed as soup with boiled rice in Korea); *Natto* (a highly sticky fermented soyabean food consumed in Japan). A total of 38 strains of dominant endospore-forming and rod-shaped bacteria were isolated from these fermented soya bean foods and studied phenotypically.

Thapa and Tamang (2004) investigated the product characterization of 40 samples of '*Kodo ko jaanr*, a fermented finger millet beverage of the Darjeeling hills and Sikkim Himalayas wherein the samples were subjected to microbiological and analytical characterization.

Tsuyoshi *et al.* (2005) studied and identified yeast strains isolated from *marcha* (cultured mixed inocula) in Sikkim. The study examined the microflora of *marcha* collected from Sikkim, focusing on genetic and phenotypic identification of 20 different yeast strains and their roles.

Thapa and Tamang (2006) studied microbiological and physico-chemical changes during fermentation of *kodo* (finger millet) *ko jaanr*, a traditional alcoholic beverage of the Darjeeling hills and Sikkim and the study revealed that *Saccharomycopsis fibuligera* and *Rhizopus* spp. play the major role in the saccharification process of finger millet (*Eleucine coracana* (L) Gaertn.) in *kodo ko jaanr* fermentation.

Thapa and Tamang (2006) studied the fermentation dynamics during production of *Bhati Jaanr*, a traditionally fermented, inexpensive, high calorific, mild alcoholic rice beverage prepared from steamed glutinous rice which is consumed as a staple food beverage in the Eastern Himalayaan region of Nepal, India (Darjeeling and Sikkim) and Bhutan. During the investigation it was revealed that *Saccharomycopsis fibuligera* and *Rhizopus* spp. play important role in the saccharification process of rice in bhaati jaanr fermentation.

Future Prospect

According to World Health Organization estimate, approximately 80 % population in the developing countries depends on the traditional medicines for primary health care needs; a major portion of these involve the use of medicinal plants[11]. In modern medicine too, nearly 25 % are based on plants or plants derived drugs [12]. The world trade on herbal medicine is now estimated at US $ 70 billion with an annual growth rate of 7% [8]. India has plans to increase the trade in medicinal plants extracts. New opportunities are thus being created that could lead to employment generation in medicinal plant sector [13]. North-East India being one of the mega hot spots of the world boasts the floristic wealth of nearly 43% of the country's total flora. A good number of known and unknown medicinal plants are found in the forests of Darjeeling Hills of West Bengal and the state of Sikkim[4, 14]. Local inhabitants used some of these plants as herbal medicines which are highly effective against some diseases. Because of their availability and utility as herbal medicine, local people have been using these plants from time immemorial.

Chemically synthesized medicines, provided by modern pharmaceutical industries, have proven their effectiveness in acute crises as well as treating severe maladies, partly because of their immediate actions. However, all chemical substances produce more or less foreseeable and adverse side effects. Harold Burns, professor of pharmacology at the Oxford University, states that "All laboratory-produced substances, strange to living beings, must be accepted with a maximum of precaution by physicians and patients and should never be regarded as harmless before having passed exhaustive tests". Though drug testing is at present stricter than ever but howsoever strict the test may be, the number of people with allergies to antibiotics and other medicines continue to increase; phenomena of digestive intolerance to medicines, especially to anti-inflammatory products, cause many medical cases; there is an increasing number of addicts to several sedatives, tranquilizers and other psycho-pharmaceuticals. One out of ten medical cases is related to a medicine's adverse side effects [15]. These more and more frequent phenomena have given rise to renewed interest in natural vegetal medicines, both by physicians and patients. All civilizations took advantage of herbs in order to ease suffering and many times, in order to cure diseases as well. May be the Creator gave humans this vegetal world with all its curative power to make our life easier. Today, we know the exact composition of many medicinal herbs, so we are able to use them rationally when needed [16].

Conclusion

The World Health Organization (WHO) defines traditional medicine as practices, knowledge and belief systems which use minerals, plants and animal based remedies, spiritual therapies and exercises to prevent, treat and maintain for the well-being of human. According to the WHO, about 80% of the population of the world depends on traditional medicine, mostly herbal remedies, for their primary health care needs [17]. The vegetation wealth has a major share of contribution on the economy of a region. In fact, the availability of diverse medicinal plants resources themselves determines the mode and status of living of a man. Darjeeling district is very rich in Medicinal plants diversity resources [18]. It is extended from tropical to alpine areas with warm to chilling climatic, which in turn helps to harbour the wide diversity of medicinal and aromatic plants resources in the region. Many plants are very effective to primary health care for poor and the people of far flung areas where transport and communication is still stump. Several plants are used in different illness and it directly helps to cure the ailing poor patients in one hand and on the other it can helps to create livelihood opportunity for many in the rural areas [19].

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