ETHNOBOTANICAL STUDIES IN INDIA WITH NOTES ON TERAI-DUARS AND HILLS OF DARJILING AND SIKKIM

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Introduction

The very survivability of man is greatly associated with plants since his origin. Plants are responsible for the supply of Man's oxygen, food, medicine, fibre, shelter and what not! Also the relationship between man and environment in general has never been static and is changing continuously. But this is not the case with tribal/ aboriginal communities the world over. The life, culture and traditions of these communities have remained almost undisturbed and static for hundreds of years. They are the living archaeological museums of ancient traditions and cultural heritage of a nation.

The Indian subcontinent is inhabited by over 53 million tribal people belonging to over 550 such communities [like *Santal, Munda, Oraon, Naga, Mompa, Karbis, Saora, Sarasia, Irulus, Chenchus, Kharia, Baigas, Bando* etc. with some degenerated communities like *Ongae, Great Andamanies, Jarawa, Sentinelese, Shompen, Toda, Toto, Asur, Birhore, Lodha* etc.] that come under 227 linguistic groups (Rao 1996). They inhabit varied geographic and climatic zones of the country and are living in complete harmony with the nature. Tribals constitute about 7.7 % of India's total population and utilize about 10,000 plant species for healthcare, food and other material requirements (Jain 1991; Pushpangadan 1994). They can extract the resources without disturbing the delicate balance of the ecosystem. Tribal people thus mostly remained as stable societies and remained unaffected by the social, cultural, material and economic evolutions that are taking place in the civilized societies. But this peaceful coexistence of the tribal-society has been violently shaken in the recent past with the interference in their habitats by so called 'civilized' outsiders. India is very rich for its 16 agro-climatic zones and its old heritage of ancient civilization with old and obsolete literatures like *Vedas, Quaran, Puran, Sanhitas, Neghuntus, Nidans, Epics* (*Ramayana, Mahabharata*), archaeological remains and sacred groves and is a virgin field for ethnobotanical studies in various aspects to get firsthand information on inter-disciplinary and intra-disciplinary subjects. However, the subject is comparatively newer to science in India, multidisciplinary in nature and unique in many ways.

The tribal people, when they are living very close to nature they have acquired and accumulated the knowledge about the use of plants growing around them. Many of these plants are not known to the outside world. After proper scrutiny this rich knowledge could benefit the mankind in many ways. The inroads of civilization are presently posing problems and imminent danger as well, for this rich and varied expertise and it is likely that this will be lost to humanity for all time to come. The habitats where the tribal lived and the environment in which the folklore evolved on the uses of wild plants are fast disappearing due to interference of outside world. Similarly with the advancement of civilization, human life

became more and more complicated and consequently the plants around human beings have been put more to use in various ways (Seitel 2001, Goel 2007).

The pre-historic people used plants quite intuitively for the fulfillments of their basic needs. Such as food, clothing, shelter, tools and even for the cure of many of their bodily disorders. The medicinal plants played a very important role from times immemorial among the illiterates to highly civilized men and women in the folklores, superstitions, traditions, various rituals, witchcraft and chanting of mantras connected with healing of diseases, and also repelling the influence of evil spirits. This man-plant relationship can be classified into two groups viz. (a) abstract and (b) concrete. The abstract relationship includes faith in good and bad power of plants, taboos, sacred plants, worship and folklore. On the other hand, the concrete relationship includes mainly the material use such as food, medicines, house building, agricultural implements and operations, other domestic uses etc (Jain 2004).

Definitions

The term ***ethnobotany*** was first coined by Harshberger (1885) – one of the pioneers of American economic botany. Robbins *et al* (1916) gave the broad definition of the area of ethnobotany that includes investigation and evaluation of the knowledge of all phases of life amongst the primitive societies and the effects of the plant environment upon life, customs, beliefs and history of the tribal people. Jones (1941) gave a concise definition of ethnobotany as the study of interrelationship of primitive men and plants. According to Jones (1941), ethnobotany is "the study of the relationship which exists between people of primitive societies and their plant environment". According to Keng (1974) "the science of ethnobotany is concerned with the relationship between man and vegetation as well as the influence, man has had on the vegetation". Ethnobotany has been defined as a multidisciplinary study involving the relationship between plant and the aboriginal people, some knowledge of anthropology of the region and a fair familiarity with the flora and vegetation of the area (Rao 1981). Its importance has been realized chiefly in respect of the varied economic uses of the plants among the primitive human societies. It brings to light numerous little known or unknown uses of plants, some of which have potential for wider usage (Rao 1981). In comparison to economic botany, ethnobotany is not only limited up to accumulation of information from a particular locality or group of people but also includes the transfer of authentic information from one sector to the other with critical scientific as well as economic evaluation for wider application (Bhattarai 1991). Wickens (1993) distinguished ethnobotany from economic botany by considering ethnobotany as "the study of useful plants prior to their commercial exploitation and eventual domestication".

The word "*Ethno*" in English came from Greek word "*ethnokos,*" meaning the human race and "botany" or plant science. Thus, ethnobotany can be defined as the relationship of plants with human beings.

History of Ethnobotanical Studies

The history of use of plants in medicine and as food can be traced back to pre-Rigvedic times. The preparation and use of medicines from plants have been mentioned in the '*Rigveda*', the earliest scripture and the oldest repository of human knowledge (4500 – 1600 BC). The Vedic Aryans were familiar with about 100 medicinal plants. Later, in '*Ayurveda*', a part of '*Atharvaveda*', various uses of plants including the medicinal properties are given. This was

followed by contributions like '*Charak Samhita*' (1000 – 800 BC. '*Sushruta Samhita*' (800 – 700 BC) and Vagbhatta's '*Ashtanga Hridaya*'. Later on, a number of books on Ayurveda and medicinal plants were written by erudite scholars like Bhikshu, Patanjali, Nagarjun, Chakradatta, Bangasen (500 – 100 BC). '*Vriksha Ayurveda*' by Parashara gives detailed characteristics of vegetable drugs including habitat, soil for growth, season of collection, duration of efficacy and method of storage (Mitra & Jain 1991).

The earliest organized worker on this aspect was Francisco Hernandry (1570 – 1575) who studied the flora and fauna of Mexico in relation to man (De 1968). The compilation of Indian medicinal plants started in the early century. Sir William Jones's '*Catalogue of Medicinal Plants*' (1799), Fleming's '*Catalogue of Medicinal Plants*' (1810), Ainslie's '*Materia Medica of Hindoosthan*' (1813), Roxburgh's '*Flora Indica*' (1820 – 1832) and Royle's '*An essay on the antiquity of Hindu medicine*' (1837) dealt mainly with plants and drugs of established indigenous systems of Indian medicine. 'O' Shaughnessy's '*The Bengal Dispensatory*' (1811) is the first book dealing exclusively with the properties and uses of medicinal plants.

Irvine (1847), Strachey (1852) and Boissier (1867) contributed significantly in the study of indigenous drugs of India in '*Pharmacopoeia of India*'; Waring (1868) has given a new dimension to the studies of medicinal plants. Modeen's *Supplement to Pharmacopoeia of India* (1869) and Fluckiger and Hanbury's (1870) *Pharmacographia* added new information. Dutta's *Materia Medica of the Hindus* (1877), Dymock's '*Vegetable Materia Medica of Western India*' (1883) and contributions of Khori (1887) and Dey (1968) are valuable contributions related to medicinal plant products. Waring (1897) contributed to the folk medicine through his '*Bazar Medicine and Common Medicinal Plants of India*'.

The **Siddha** system of medicine is considered as a branch of **Ayurveda** with advancement in respect of a few selected medicinal plants and was evolved by Sadhus (sages) in South India. The **Unani** system of medicine is supposed to be a contemporary of Siddha system developed by Muslim physicians during the Mohammedans rule. The allopathic medicine originated in Europe and became dominant in India with the establishment of British Empire.

Barrow (1900) worked on the ethnobotany of Coanhilla, Spruce (1908) worked on tribes of Andes and Amazon regarding the knowledge of using rubber plants. Safford (1915 – 1917) studied narcotic and stimulant plants of Haiti and Aztec region. In North America, considerable amount of work was done among the Red Indians. In South America, some work was done in Peru. The major contributions of Schultes (1941, 1956, 1960, 1963, 1967, 1987 a.b. 1988, 1990, 1992, 1993, 1996), who is considered as Father of modern Ethnobotany, include its various aspects like wild edibles, narcotic drugs, psychoactive plants, hallucinogens etc. The other specialized branches of ethnobotany are archaeo-ethnobotany, ethno-agriculture, ethno-ecology, ethnopharmacology, etc.

The remarkable progress of Hindu medicine from Vedic to the period of Tantras and Siddhas declined with the invasions of Greeks, Scythians, Huns, Moguls and Europeans. However, with the establishment of British rule in India, there was further intermingling and also introduction of some new medicinal plants.

In India much works on Ethnobotany have been accumulated and researches in the field are gaining momentum which is evident from the literature pilings up at rapid rate.

Fuchs (1908) studied the Korkus of Vindhya Hills; Guha (1939) studied Garo tribe from Assam region, while Dastur (1951) contributed to the medicinal plants of India and Pakistan. Elwin (1955) worked on the religious aspects of Indian tribes. Gupta (1960) enumerated 101 useful and medicinal plants of Nainital in Kumaon Himalaya, Jain (1963a,b) studied Madia tribe from Bastar region of Madhya Pradesh. The contributions of Jain and his co-workers (1965, 1967, 1971, 1987) worked on plants used for various purposes. Dr. S.K. Jain, former Director of Botanical Survey of India, is also credited for the establishment of the *Society of Ethnobotanists* and its official journal ***Ethnobotany***.

Janardhanan (1963) enumerated the medicinal plants of *Khed taluka* of Pune district and provided information regarding their use and mode of administration. Contributions of Gupta (1963) on Chotanagpur plateau; Jain and Tarafder (1983a) on native plant remedies for snakebite among the tribal people of central India etc. are noteworthy contributions. The wild food plants used by tribes like Madia, Halba, Gond were noted by Jain (1964). Dhar *et al* (1968-88) screened Indian medicinal plants for antimicrobial activity. Preliminary screening of 202 plant species for alkaloids, saponins and steroids was done by Maiti (1968). Malhotra & Moorthy (1973) recorded useful and medicinal plants from Chandrapur district. Das & Mandal (2003) and Das *et al* (2006) enumerated the Medicinal Plants of Darjiling area.

Venkatram *et al* (1975) reported the identity and therapeutic claims of 'Sanjeevinee' with miraculous panaceal properties and sold in certain parts of Karnataka and Maharashtra. Vartak & Datar (1975) enumerated wild edibles of Karnala Bird Sanctuary. Gadgil & Vartak (1976) studied the sacred grooves of Western Ghats, Dan *et al* (1978) did phytochemical screening of plants from Indian Botanic Garden, Brahmam & Saxena (1978) conducted survey of plants from Orissa for tannins, saponins, flavonoids and alkaloids. Tiwari *et al* (1978, 1980) contributed on the primitive tribes of Eastern Ghats and their medicinal folk lore. Similarly, Bedi (1978) worked on Ratanmahal Hills of Gujarat, the area predominantly inhabited by Bhils. Kumar *et al* (1980) supplemented information on Garo tribe of Meghalaya and Maheshwari *et al* (1980) on Tharus of Uttar Pradesh. Joshi *et al* (1980) studied the ethnobotany of Gujarat with reference to folk medicine used by Dang tribe. Daniel (1980) analysed 150 plants of Gujarat forests for alkaloids, saponins and tannins. He has also screened 200 and more plants for the presence of economically important natural products.

Singh and Pande (1980) reported plants used by tribes of Eastern Rajasthan, Pal (1980) collected plants used in veterinary medicine by the tribes of Bihar, Orissa and West Bengal. Kamble and Pradhan (1980) collected medicinal plants used by the Korku tribe in Akola district of Maharashtra state. Sharma and Kulkarni (1980) studied sacred grooves of Kolhapur district. Thakre (1980, 1983), studied the efficacy of common medicinal plants against bacteria. Ramchandran and Nair (1981) reported the traditional uses of 138 species belonging to 199 genera and 52 families by the *Irulas* of Tamil Nadu. Vartak and Gadgil (1981) studied sacred grooves along Western Maharashtra and Goa. Tripathi and Rastogi (1981) have illustrated the effects of flavonoids in biology and medicine and recommended the flavonoids isolated from seeds of *Rhamnus infectoria* for use in ophthalmology. Shah *et al* (1981) enumerated the ethnobotanical notes on 133 plants belonging to 54 families from Saurashtra in Gujarat. Kamboj and Dhawan (1982) reported antifertility and abortifacient herbal drugs used by primitive societies of India. Shah *et al* (1983) recorded medicinal plants from Dahanu forest region of Maharashtra state. Tarafder (1983, 1984) listed plants used by tribal people for antifertility, abortion and conception. Bhargava (1983) studied different tribes of

Andaman and Nicobar Islands. Sen *et al* (1983) have done ethnobotanical study of Kuchla (*Strychnos nux-vomica)* and Gunjatkar and Vartak (1983) studied fish tail plam (*Caryota urens*). Jain and Puri (1984) explored the ethnobotanical properties of 100 plants of Jausar-Bawar hills of Uttar Pradesh. Hemadri and Rao (1984) described 17 plants exclusively used in the treatment of jaundice by the tribal people of Dandakaranya. Yoganarsimhan *et al* (1984) described 210 plant species belonging to 79 families of Andaman and Nicobar Islands. Pushpangadan and Atal (1984) described ethnomedico-botanical investigation of 79 species used by tribal people of Western Ghats in Kerala. Sharma and Malhotra (1984) studied some tribal areas of Maharashtra state.

Nilegaonkar *et al* (1985) analysed 13 species of wild edibles used by tribal people of Pune and Ahmadnagar districts and found that the protein value of wild leafy vegetables are higher than that of conventional leafy vegetables. Atique *et al* (1985) did ethnobotanical study of cluster fig (*Ficus racemosa*). Shah and Gopal (1985) studied Bhil, Gharasia and Dubla tribes of North Gujarat. Sharma and Vyas (1985) reported the medicinal importance of ferns used by the tribes of Rajashtan. Lal *et al* (1985) described ethnobotanical uses of lichens. Ramashankar and Khare (1986) studied phytochemistry of *Adiantum coudatum* and *Cheilanthus farinosa* and revealed the presence of alkaloids, steroids and flavonoids in those. Irawati *et al* (1986) cultured corms of *Amorphophallus companulatus* on Murashige and Skoog's medium. Saxena and Vyas (1986), tested seeds of *Nigella sativa, Argemone mexicana, Brassica juncea* and other ethnomedicinal plants for their antimicrobial activities against human pathogenic fungi. Jain *et al,* (1987) described the method of oil extraction from moul (*Bassia latifolia*) seeds.

Organized ethnobotanical work in India started with the publications by Janaki Ammal (1956) and Jain (1963). These investigations formed the foundations of modern ethnobotany and also prompted a large number of research workers from different parts of the country to venture into the field. The *'All India Coordinated Research Project of Ethnobiology"* involving several centers viz. Botanical Survey of India, National Botanical Research Institute, Regional Research Laboratories and some Universities launched in 1980s by the Ministry of Environment and Forests, Government of India, acted as a booster for many young workers to initiate ethnobiological researches in the country. Traditional medicinal plants are the main focus in these studies. As has already been mentioned that there are about 53 million tribal people belonging to over 550 tribal communities are living in India (Rao 1996). Only limited number of tribes has retained their original culture. The increase in the population level in tribal communities, their migration to other places in search of food, welfare schemes for the tribal communities floated by State and Central Government and impact of civilization, etc. have all collectively changed the lifestyle and age-old culture of the tribal people in several parts of the country. The cumulative effect of these activities is detrimental where the culture of the aboriginals and invaluable knowledge of medicinal and other useful plants are threatened. In order to protect ethnobiology, the traditional cultures and also the forests and other types of vegetation which nourishes the culture should be conserved.

All systems of traditional Indian medicine had their roots, in one way or the other, in folk medicines and household remedies. Whereas, some of those earliest remedies and prescriptions became widespread and were subjected to certain refinements, revisions and improvements through practices by trained medicine men have thus got incorporated in

organized system of medicine. But a major bulk of old medicines remained endemic to certain regions or people in the country. Due to lack of communication of intermingling and breeding of ideas and varying ways of life, many of these earlier remedies survived only by words from generation to generation. These are being practiced particularly in remote rural areas and tribal societies. The lack or absence of acculturation has in many instances, helped in preservation of this knowledge almost in original form (Jain 1981). Approximately 85% of the rural population of India depends upon wild verities of plants for the treatment of various diseases they are suffering. But unfortunately, due to rapid spread of the facilities of civilization and acculturation tribal environment, cultures, their faith and belief are rapidly changing with a downward trend. The indiscriminate exploitation and destruction of forest, spread of harmful chemicals, introduction of alien species and over exploitation of natural resources, a number of taxa have already been disappeared and others are awaiting a similar fate, even before we became aware of their existence. It is therefore, important to preserve the oral folklore on plants and plant resources before it is lost.

Importance of Studying Ethnobotany

Ethnobotany represents best avenues for screening new economic plants for food, medicine, etc. as well as for gene pool source for the development of agricultural and medicinal crops. For this purpose, a close collaboration is required among agriculturists, phytochemists, pharmacologists, nutritionists and ethnobotanists. This will not only lead to the discovery of new economic plants but also result in better understanding the relationship between primitive societies and modern science. However, the significance of Ethnobotany is multifaceted and multi-dimensional in nature. The following may be included under its coverage (Pal 2007):

(a) Man-plant interaction in human society.

(b) Historical understanding based on existing human culture.

(c) Genetic pool for resistant crops and for development of hybrid plant species.

(d) Scientific investigation of herbal practices exists among different ethnic communities and tribal groups to discover new medicinal plant species, new area of knowledge, treatment, therapies and drug development.

(e) Development of traditional technologies with scientific imputes for the benefit of artisan classes and for sustainable utilization of natural resources.

Sacred Groves

Tribal people have their own way of conservation. They are aware of the importance and level of their dependence on forests. Sometimes patches of forests are preserved on religious ground and are referred as *Devrai* or *Dev Rahati* or *Gram Than* or *Jaherthan*, etc. (i.e. sacred groves). These sacred groves remain free from human interferences due to religious beliefs or in the name of God! There are over 230 such groves found in Maharashtra (Gadgil & Vartak 1981). A sacred grove is a patch of vegetation associated with some deity. These are protected through the grace of deity. Thus, removal of any plant material (even a piece of dead wood) or killing any animal from sacred grove is a sin. Tribal people believe that breaking the law may result in serious illness or even to death (Gadgil & Vartak 1981; Dash & Chouhan 2002).

Drugs from Ethnic Formulations

In Indian premier institutions like the Central Drug Research Institute (CDRI), Central Institute of Medical and Aromatic Plants (CIMAP), Regional Research Laboratory, Jammu (RRL) and Tropical Botanic Garden and Research Institute (TBGRI) are working on medicinal plants. These institutions are engaged in gathering the information from different tribal pockets in India. They are evaluating the efficacy of drugs by photochemical and biological testing. Recently TBGRI is equipped with cryobank facility where medicinal plants are cryopreserved. The medicinal plant conservation park (MPCP) is also being developed at TBGRI, where about 450 medicinal plants are being conserved (TBGRI News 1995).

Remedies in traditional medicine consist of formula prepared from various natural substances, animals and vegetables. The vegetable remedies account for about 90% of these. Great importance is attached to the proper preparation of all herbal drugs, which are considered ineffective unless pre-treated in a prescribed manner. These herbal remedies are either swallowed, rubbed into scarification, poured into wounds, boiled and inhaled as fumes, splashed on to eyes, smoked in pipes or snuffed as snuff.

This system of medicine which is the only easy and accessible health care system for most of the population in rural areas needs to be evaluated scientifically, given due recognition and developed so as to improve its efficacy and safety. The chemical constituents of most of the herbs used by traditional healers are still unknown. It is, therefore, of paramount importance to know the chemical components of every reported herb and to make permanent records of the knowledge from the 'medicine men' before they all pass away. India has a vast reservoir of nearly 400,000 practitioners of *Ayurveda, Siddha, Unani* etc. whose services could not be adequately utilized in the health care delivery systems. The proper use of medicinal plants is a necessity and not a luxury. The use of medicinal plants in traditional medicines finds its natural expression and further development in primary health care. In China for example medicinal plants are an integral part of the formal health system and are utilized in about 40% of cases at the primary care level. It is often claimed and widely believed that remedies of natural origin are harmless and carry no risk to the consumer.

It has already been mentioned that the earliest drugs were plant extracts followed by pure natural compounds of known structures. This then followed the domination of completely synthetic chemical drugs. But, in recent years people are becoming conscious of the increased potency and harmful effects of synthetic drugs. Disillusioned with synthetic western medicine, more and more people are now realizing that natural medicine is better and we are now trying to return to the fold of traditional herbal systems. The World Health Organization (WHO) also admitted that it will not be possible or even desirable to replace this herbal medicine with western techniques, which leads to a revival of interest in wild medicinal plants. This 'green wave' (Tyler 1986) is likely to gain momentum in the years to come. The immense possibilities of these systems in achieving the proclaimed goal of "Health for all by 2000 AD" as enshrined in the Alma-Ata declaration are now being realized by the international community. They are now groomed as sources of alternative medicine can best be utilized on a global basis (Farnsworth 1984).

Secondary metabolites in plants are commercially used as biologically active compounds. So far only 5 – 15% of world's existing species has been surveyed for biological active compounds in developing countries and thereby do not have a clear picture of the biodiversity and the richness of their natural resources. This is alarming in view of the current

rate of extinction of tropical vegetations which hosts most of the world's plant species. With its present rate, phytochemists may have only a few decades remaining to evaluate a large part of the plant kingdom. This prompted interest in the tropical forest, where biological diversity is at the highest and indigenous population have a unique knowledge about plants and their medicinal properties.

In the deluge of modernism, valuable and time-tested ethnobiological knowledge connected with agriculture, folk-medicine, etc. is fast disappearing. In most cases such knowledge provided by natives is generally ignored. As a result, this rich and useful source of information has almost died up. Before this is completely lost to civilization, efforts to record such information and to preserve the gene pool should be taken up on an emergency basis (Manilal 1992).

The best recent example is the novel information provided by ***Kani*** tribe from Agastyamalai hills in Western Ghats, Kerala pertaining to antifatigue properties from the fruits of *Tricopus zeylanicus* ssp. *travancoricus* ('Aryogyapacha') lead to the development of an anti-fatigue drug named as ***Jeevani*** at Tropical Botanic Garden and Research Institute (TBGRI), Thiruvananthapuram (Kerala). Kanis chew these tiny fruits as instant source of energy and anti-fatigue agent when they climb hilly slopes carrying heavy head-loads. Laboratory tests confirmed its immuno-enhancing properties. Intake of fruits relieves fatigue, protects liver and boosts the immune system of body (Pushpangadan 2002; Pushpangadan *et al* 1997).

Ethnobotanical data used to get back patent

U.S. patent no. 5401504 was granted in March 1995 to Mr. Suman Das and Mr. Hari Har P Cohty, Scientist of University of Mississipi for describing a method to promote wound healing with turmeric powder extracted from *Curcuma longa.*

The CSIR (Council of Scientific and Industrial Research) challenged the patent in October, 1996 and got it back with the production of 32 Indian documents out of which Jain (1991) and Sivananda (1958) publications played a vital role.

Modern Ethnobotany questionnaires

Modern ethnobotany is concerned with the totality of the place of plants in a culture (Ford 1978). Al Corn (1995) specified certain questionnaires to the Ethnobotanists for studies in fields and are: *(i) What plants are available? (ii) Why are they available? (iii) What plants are recognised as resources? (iv) What social, political, biological, economic and ecological factors cause particular plant to be prescribed as source? (v) How does the use of a certain set of resources influence the use of others? (vi) How is Ethnobotanical knowledge distributed among the human population? (vii) What do people think about plants? (viii) How do they differentiate and classify elements of their natural environment? (ix) From what resource zones are plant products harvested? How are they used? (x) What are the economic and financial benefits derived from plant? (xi) How are populations of resources maintained? (xii) What effect does their management have upon the structure of local vegetation? (xiii) What effect does their management have upon the structure and functioning of local institutions? (xiv) What factors influence resource management decisions and thereby affect local plant populations? (xv) How have human activities and their consequences influenced the evolution of local plant populations? (xvi) For what purposes are resources needed?*

(xvii) To what resources are human populations adapted? (xviii) Are human choices of particular resources adaptive? (xix) If so, to what are they adaptive? (xx) How are human adaptive strategies affected by change? (xxi) What changes are presently accruing and what changes have taken place in past?

Ethnobotanical Studies in Terai, Duars and Hills of Darjiling and Sikkim

Terai, Duars and hills of Darjiling and Sikkim are inhabited by a very high proportion of tribal people. While there are some migratory groups like Santal, Oraon, Munda, Khariya, Baraik etc. from Santalparganas and some indo-mongoloid tribes like Mech, Rava, Toto, Rajbanshi, etc. are living mainly in Terai and Duars, and Lepcha, different Nepali and Bhutia communities are dominating in hills of Darjiling and Sikkim. Almost no ethnobotanical work has been carried out on the tribes living in Terai and Duars. Very recently Ghosh and Das (2004a) has studied the method of *Jhara* preparation by the Oraons living in Terai Tea Gardens. They (Ghosh and Das 2003 a,b, 2004b 2006, 2007) have also studied other aspects of ethnobotany among the Tea Garden workers. Roy and Das (2004) studied some unique methods of preparing food by Rajbanshi community in Duars. Sarkar and Das (2004, 2005, 2006) are taking intensive interest in the ethnobotany of Meches in Duars. Though much sociological surveys has been conducted on tribal communities in Terai and Duars but ethnobotanical works are completely lacking. Pandit *et al* (2004) made an exhaustive survey of Non-timber Forest Produces of Jaldapara Wildlife Sanctuary those are mostly harvested by local tribal communities.

Due to contiguity and similarities in the structure of formation of hills as well as the vegetation structure, Darjiling and Sikkim parts of Himalayas are considered as single unit. The type of people, their language, culture and customs are quite similar. However, in Sikkim human settlements are distributed upto much higher elevation areas and with richer biodiversity. Apart from very early botanical documents (like Anonymous 1893; Cowan and Cowan 1929; Krishna and Singh 1987) where local uses of some plants also have been noted, true Ethnobotanical works are lacking.

Hajra and Chakraborty (1981) listed the wild plants sold in the Lal Market of Gangtok. G.S. Yonzone (Yonzone *et al* 1984, 1985, 1996; Yonzan 1987) and R. Yonzone (Yonzone *et al* 1981, 1982) recorded a good bulk of Ethnobotanical knowledge from Darjiling area. R.B. Bhujel recorded the edible and poisonous plants of Darjiling in detail (Bhujel *et al* 1984 a,b,c, 1996). With S.K. Rai he did contributed a lot to the ethnobotany of this region (Rai and Bhujel 1997, 1999, 2002, 2003, 2007; Rai *et al* 2007) including medicinal, dye & gum yielding plants, plants related to birth, marriage and death etc. P.C. Rai did some stray works in Darjiling and Sikkim (Rai and Das 1996, 2001, Rai *et al* 1998). P.C. Lama also made a detailed Ethnobotanical study in Sukhia Pokri area.

In Sikkim too there are some other small works by Bennett (1983, 1985) and Jana *et al* (1998).

Conclusion

Ethnobotany is still a young subject in India. Numerous interesting pockets are yet to be touched including the states of Northeast India. Studies made in Sikkim and Darjiling are also quite few and are far from producing a good workable picture for the region. For Terai and Duars the work done is just negligible. The developmental works are in good progress in this

entire region and it is important to complete the recording of Ethnobotanical data from this region within next ten years.

References

Anonymous 1893. Botanical explorations in Sikkim -Tibet Frontier. *Kew Bull.* 297- 315.

Atique A, Iqbal M, Ghouse AKM 1985. Ethnobotanical study of Cluster fig. (*Ficus racemosa*) *Fitoterapia* 56(4): 236 – 240.

Barrows D 1900. Ethnobotany of the Coahuilla Indians. Chicago Univ. Press. (Reprinted 1967 Malki Muss Press, California).

Bedi SJ 1978. Ethnobotany of Ratan Mahal Hills, Gujarat. *Econ. Bot.* 32: 278 – 284.

Bennet SSR 1983. Ethnobotanical studies in Sikkim. *Indian Forester* 109: 477 – 481.

Bennet SSR 1985. Ethnobotanical studies in west Sikkim. *J. Econ. Tax. Bot.* 7: 317 – 321.

Bhargava N 1983.Ethnobotanical studies of the tribes of Andaman and Nicobar Islands, India – I. *Econ. Bot.* 44(3): 382 – 390.

Bhattarai A 1991. Ethnobotanical Observations in the Ladakh region of Northern. Jammu and Kashmir State, India. *Econ. Bot.* 45(3): 305 – 308.

Bhujel RB, Tamang KK, Yonzone GS 1984a. Edible plants of Darjeeling District. *J. Beng. Nat. Hist. Soc.* 3(1): 76 - 83.

Bhujel RB, Tamang KK, Yonzone GS 1984b. Poisonous plants of Darjeeling District. *J. Him. Res. Dev.* 31 - 34.

Bhujel RB, Tamang KK, Yonzone GS 1984c.. Edible wild plants of Darjeeling district. *J. Beng. Nat. Hist Soc.* (n.s.) 4(2): 150 - 152.

Bhujel RB 1996b. A successful herbal drug practitioner of Darjeeling Hills: Baidhya Chewang Pakhrin -A profile. Biswas, K. & Chopra, R.N. 1956. *Common Medicinal plants of Darjeeling and Sikkim Himalayas.* (Reprinted 1982) Soni Reprint, New Delhi.

Boissier E 1867. Flora Orientalis, 5 Vols, Paris, London

Brahmam M, Saxena HO 1978. A survey of the plants of Orissa (India) for tannins, saponins, flavonoids and alkaloids II. *Bull. Bot. Surv. India* 20(1-4): 72 – 79.

Cowan AM, Cowan JM 1929. *The trees of North Bengal including shrubs, woody climbers,*

Dan SS, Mondal NR, Dan S 1978. Phytochemical Screening of some plants of Indian Botanic Garden. *Bull. Bot. Surv. India.*20(1 – 4): 117 – 123.

Daniel M, Sabnis SD, Prathapasenan G 1980.A phytochemical survey of plants of the forests in Gujarat for alkaloides, saponins and tannins. *Ind. J. Forestry.*3(3): 238 – 248.

Das AP, Mandal S 2003. *Some Medicinal Plants of Darjeeling Hills.* WWF-India, Calcutta.

Das AP, Alam MU, Sen A, Ghosh C, Sen S 2006. *Medicinal Plants: Suitable for cultivation in Northern Bengal.* University of North Bengal

Dash SS, Chauhan AS 2002. Kabi sacred Grove in Sikkim – relevance to conservation. In *Perspectives of Plant Biodiversity,* ed. A. P. Das. pp. 713 – 731. Bisen Singh Mahendra Pal Singh, Dehradun.

Dastur JF 1951. *Medicinal Plants of India and Pakistan*. Bombay.

De JN 1968. Ethnobotany – A newer science in India. *Soc. & Cult.* 34: 326 – 328.

Dhar ML, Dhar MM, Dhawan BN, Mehrotra BN, Ravi CV (and associates) 1968 – 1988. Screening of Indian Plants for Biological activity (In 13 Parts) *Ind. J. Exp. Biol.* 6: 232 – 247; 7: 250 – 262; 9: 91 – 102; 11: 43 – 52; 12: 512 – 523; 15: 208 – 219; 15: 231 – 232; 16: 330 – 339; 18: 594 – 606; 22: 312 – 332; 23: 487 – 504; 24: 48 – 68; 26: 883 – 904.

Elwin V 1955. *The Religion of an Indian Tribe*. Oxford Univ. Press, London.

Farnsworth NR 1984. How the well can be dry when it is filled with water? *Econ. Bot.* 38: 4 – 13.

Fluekiger FA, Hanbury D 1870. *Pharmacographia*. 1 – 803. McMillan and Co., London.

Francisco – Hernandery (1570 – 1575) Cf. J.A. De 68. Ethnobotany: A newer science in India *Sci. and Cult.* 34: 326 – 328.

Ford RI (Ed.). 1978. *The nature and status of ethnobotany*. Ann. Arbor. Michigan.

Fuchs S 1908. The Korkus of Vindhya Hills. Inter India Publication, New Delhi.

Gadgil M, Vartak VD 1976. Sacred groves of western ghats of India. *Economic Botany.* 30: 152 – 160.

Gadgil M, Vartak VD 1981. Sacred Grooves of Maharashtra: An Inventory. In JAIN, S.K. (ed.) Glimpses of Indian Ethnobotany P. 279 – 294. Oxford and IBM Publishing Co., New Delhi, Bombay, Calcutta.

Ghosh C, Das AP 2003a. Ethnobotanical Studies Among the Tea Garden Workers in Darjiling, West Bengal (India). *Ann. Bot. Conf.. 2003*, Jahangirnagar Univ., Bangladesh. P: 4.

Ghosh C, Das AP 2003b. Plants of Ethnobotanical Significance among the Tea Garden Workers of Darjiling Hills in West Bengal. *Abstr. Intn. Symp. Pl. Tax. Adv. Relev.*, T.M. Bhagalpur Univ., Bhagalpur. P: 67.

Ghosh C, Das AP 2004a. The materials and method of *Jhara* preparation by the tribal inhabitants of Tea Gardens in Terai of West Bengal (India). *Indian Journal of Traditional Knowledge,* 3(4): 373 – 382.

Ghosh C, Das AP 2004b Use of Medicinal Plants among the Tea Garden Workers in North Bengal Terai and Duars. *Abstr. National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation.* TBGRI, Thiruvananthapuram

Ghosh C, Das AP 2006. Use of Medicinal Plants among the Tea Garden workers in Darjeeling Hills. *Nat. Sem. Env. Sustainable Develop.*, Raiganj College, Raiganj. P: 12.

Ghosh C, Das AP 2007. Plants of ethnobotanical significance among the Tea Garden workers of Darjiling Hills in West Bengal. In *Advances in Ethnobotany*, ed. A.P. Das & A.K. Pandey (in press)

Goel AK 2007. Ethnic and folklore knowledge: gateway to the sustainable use of plant diversity. In *Advances in Ethnobotany*, ed. A.P. Das & A.K. Pandey (in press)

Guha BS 1939. 'Simphak' – the bark cloth of the Garos of Assam. *J. Asiat. Soc.* 6: 174.

Gunjatkar N, Vartak VD 1983. Ethnobotanical and floristic studies on Bherlimad (*Caryota urens*) from Western India. *J. Econ. Tax. Bot.* 4(2): 323 – 330.

Gupta SP 1963. An appraisal of Chotanagpur tribal pharmacopoeia. *Bull. Bihar Trib. Res. Inst.* 5(2): 1 – 18.

Hajra PK, Chakraborty P 1981. A survey of wild plants sold in the Lal Market of Gangtok. Indian J. For. 4: 217 – 220.

Harshberger JW 1885. Some New Ideas: The Plants cultivated by Aboriginal People and how used in Primitive Commerece. *The Daily Evening Telegraph, Philadelphia* 64(134):2.

Hemadri K, Rao RS 1984. Jaundice: Tribal medicine. *Anc. Sci. Life* 3: 209 – 212.

Irawati J, Arditti, Nyman LP. 1986. *In vitro* propagation of Elephant Yam. *Amorphophallus companulatus* var. *hortensis* Backer (Araceae). *Annals of Botany* 57: 11 – 17.

Irvine RH 1847. *A Short Account of Materia Medica of Patna*. W. Rishdale, Calcutta.

Jain SK 1963a. Observations on the ethnobotany of the tribals of Madhya Pradesh. *Vanyajati* 11: 177 – 188.

Jain SK 1963b. The origin and utility of vernacular plant names. *Proc. Nat. Acad. Sci.* 33B: 525 – 530.

Jain SK 1964. The role of botanist in *Folklore* research. *Folklore* 5 (4): 145 – 150.

Jain SK 1965. Medicinal plant lore of the tribals of Bastar. *Econ. Bot.* 19: 236 – 250.

Jain SK 1967. Ethnobotany. Its scope and study. *Indian Mus. Bull.* 2: 39 – 43.

Jain SK 1971. Some megico – religious beliefs about plants among adibasis of Orissa. *Adibasi*12: 39 – 44.

Jain SK 1981 (ed.). *Glimses of Indian Ethnobotany*. Oxford & IBH. New Delhi

Jain SK 1987. Ethnobotany- its concepts & relevance X botanical conference, Indian Botanical Society, Presidential address, pp. 7-10.

Jain SK 1991. *Dictionary of Indian Folk Medicine and Ethnobotany*. Deep Publications, New Delhi.

Jain SP, Puri HS 1984. Ethnomedicinal plants of Jaunsar – Bawar hills, Uttar Pradesh, India. *J. Ethnopharmacol.* 12: 213 – 222.

Jana SK, Das AP, Chouhan AS 1998: Some interesting medicinal plants used by the Bhutias of Lachen and Lachung valley of North Sikkim. *Abstr. Nat. Sem. Biodv. Cons. Taxo. Trop. Flr. Pl.*, Calicut.

Janaki Ammal EK 1956. Introduction to the subsistence economy of India. In William, L.T. Jr. (ed.) Man'sRole in Changing Face of the Earth. 324 – 335. Chicago Univ. Press, Chicago.

Janardhanan KP 1963.An enumeration of the medicinal plants of Khed taluka, Maharashtra State. *Bull. Bot. Surv. India* 5: 363 – 374.

Jones VH 1941. The nature and scope of Ethnobotany. *Chronica Botanica* 6(10): 219 – 221.

Joshi MC, Patel MB, Mehta JP 1980. Some folk medicines of Dangs, Gujarat State. *Bull. Medico. Ethno. Bot. Res.* 2: 150 – 192.

Kamble SV, Pradhan SG 1980. Ethnobotany of Korku in Maharashtra. *Bull. Bot. Surv. India* 22(1 – 4): 201 – 202.

Kamboj VP, Dhawan BN 1982. Research on plants for fertility regulation in India. *J. Ethnopharmacol.* 6: 191 – 226.

Keng H 1974.Economic plants of Ancient North China as mentioned in Shih Ching (Book of Poetry) *Econ. Bot.* 28: 391 – 410.

Khory RN 1887.The Bombay Materia Medica and their Therapeutics. 1 – 600. Ranina Union Press, Bombay.

Krishna B, Singh S1987. Ethnobotanical observations in Sikkim. *J. Econ. Tax. Bot.* 9(1): 1 – 7.

Kumar Y, Haridasan K, Rao RR 1980. Ethnobotanical notes on certain medicinal plants among some Garo people around Balphakrah Sanctuary in Meghalaya. *Bull. Bot. Surv. Ind.* 22: 161 – 165.

Lal B, Upreti DK, Kalakoti BS 1985. Ethnobotanical utilization of lichens by the tribals of Madhya Pradesh. *J. Econ. Tax. Bot.* 7(1): 203 – 204.

Lama PC 1989. A preliminary report on the ethnobotanical importance of the Sukia Pokhri region of Darjeeling Himalayas. *J.Beng Nat. Hist. Soc.* (n.s.) 8(1): 56 – 62.

Maheshwari JK, Singh KK, Saha S 1980. Ethnomedicinal plants used by Tharus of Kheri District, Uttar Pradesh. *Bull. Medico. Ethnobot. Res.* 1: 318 – 337.

Maiti PC 1968. Phytochemical screening. *Bull. Bot. Surv. India* 2: 111 – 122.

Manilal KS 1992. *Proceedings of International Symposium on Genetics.* Calicut University, Calicut.

Mitra R, Jain SK 1991. Medicinal plants research in India – a review. *Ethnobotany* 3: 65 – 77.

Nilegaonkar S, Vartak VD, Chitre RG 1985. Nutritional evaluation of some wild food plants from Pune and neighbouring districts, M.S. (India). *J. Econ. Tax. Bot.* 6(3): 629 – 636.

Pal DC 1980. Observation on folklore about plants in veterinary medicine in Bengal, Orissa and Bihar. *Bull. Bot. Surv. India* 22: 96 – 99.

Pal DC 2007. Ethnobotany. In *Advances in Ethnobotany*, ed. A.P. Das & A.K. Pandey (in press)

Pandit PK, Ghosh C, Das AP 2004. Non-timber Forest Produces from Jaldapara Wildlife Sanctuary: an Assessment. *Indian Forester* 130: 1169 – 1185.

Pushpangadan P 1994. *All India Coordinated Research Project on Ethnobiology (AICRPE) - An Overview*. Ministry of Env. & Forests, Govt. of India.

Pushpangadan P 2002. The role of ethnobotany in the 21st century. In *Perspectives of Plant Biodiversity*, ed. A. P. Das. pp. 613 – 619. Bisen Singh Mahendra Pal Singh, Dehradun.

Pushpangadan P, Atal CK 1984. Ethno-medicobotanical investigations in Kerala. I. Some primitive tribals of Western Ghats and their herbal medicine. *J. Ethnopharmacol.* 11: 59 – 77.

Pushpangadan P, Kumar R, Santosh V (ed.) 1997. *Conservation and Economic Evaluation of Biodiversity*. vols. 1-2, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Rai PC, Das AP 1996. Survey of the diversity of ethnobotanical plants in Kurseong sub-division of Darjeeing district, West Bengal, *Nat. Conf. Relev. Taxo. Cons. Biodiv*; Sagar.

Rai PC, Das AP 2001. Ethnobotanical significance of the flora of Neora Valley National Park in Darjeeling District of West Bengal (India). Abstr. Nat. Sem. Pl. Syst. 21st Cent. Appro. Prosp., Dehradun. P 46.

Rai PC, Sarkar A, Bhujel RB, Das AP 1998. Ethnobotanical studies in some fringe areas of Sikkim and Darjeeling Himalayas. *J. Hill Res.* 11(1): 12 - 21.

Rai SK, Bhujel RB 1997. Wild medicinal plants in the Eastern Himalaya – conservation and propagation aspects. *Hill Hort. News* 2 (3&4): 2 – 5. Kalimpng.

Rai SK, Bhujel RB 1999. Notes on some less known ethnomedicinal plants from the Darjeeling Himalayas. *J. Hill Res.* 12 (2): 160 – 163.

Rai SK, Bhujel RB 2002. Ethnic uses of some monocotyledonous plants in the Darjeeling Himalayan region. In *Perspectives of Plant Biodiversity*, ed. A. P. Das. pp. 635 – 644. Bisen Singh Mahendra Pal Singh, Dehradun.

Rai SK, Bhujel RB 2003: Genetic Resources, Cultivation and Marketing of Medicinal Plants in Darjeeling Hills; in Samuel.Rai & Anita Rai ed. *Cultivation and Marketing of Agri-Horticultural Crops, Dairy, Husbandry and Post harvest Technology*, pp 29-34. Kalimpong, Darjeeling, India.

Rai SK, Bhujel RB 2007. Dye and gum yielding plants of Darjeeling Himalaya, India. In *Advances in Ethnobotany*, ed. A.P. Das & A.K. Pandey (in press)

Rai SK, Bhujel RB, Das AP 2007. Ethnobotanical studies in Darjiling Himalaya in relation to birth, marriage and death. In *Advances in Ethnobotany*, ed. A.P. Das & A.K. Pandey (in press)

Ramashanker, Khare PK 1986. Phytochemical studies of Adiantum caudatum L. and Cheilanthus farinose Kauf. Proc. Nat. Acad. Sci. India 56(B), III: 244 – 246.

Ramchandran VS, Nair NC 1981. Ethnobotanical Observations on Irulas of Tamilnadu, India. *J. Econ. Tax. Bot.* 2: 183 – 190.

Rao RR 1981. Ethnobotanical studies on the flora of Meghalaya – some interesting reports of herbal medicines, In Jain, S.K. (ed.) Glimpses of Indian Ethnobotany. 137 – 148. Oxford and IBH Publ. Co., New Delhi.

Rao RR 1996. Traditional knowledge & sustainable development : Key role of ethnobotanists. Ethnobotany 8 (1& 2):14-24, Lucknow.

Robbins WW, Harrington JP, Ferriere – merreco 1916. Cf. R.E. Schuites (1967) *The place of ethnobotany in the pharmacologic search for psychoactive drugs*. In D. Efron (ed.) U.S. Public Health Serv. Publ. No. 1645: 33 – 57.

Roy S, Das AP 2004.Some favourite Rajbanshi cuisine from northern West Bengal, India. *Nat. Sem. New Front. Pl. Tax. Biodiv. Cons.*, TBGRI, Thiruvananthapuram.

Safford WE 1915. The Aztec narcotic. *J. Hered.* 6: 292 – 311.

Safford WE 1916. Identity of cohoba, the narcotic snuff of ancient Haiti. *J. Wash. Acad. Sci.* 6: 547 – 562.

Safford WE 1917. Narcotic plants and stimulants of the ancient America. Ann. Rep. Smithson Inst. 387 – 424.

Sarkar Ajita, Das AP 2004. Preliminary Report on the Ethnobotanical Studies on Autochthonous Mechs in Sub-Himalayan West Bengal, India. *Nat. Sem. New Front. Pl. Tax. Biodiv. Cons.*, TBGRI, Thiruvananthapuram.

Sarkar Ajita, Das AP 2005. Wild Edible Plants for the Mechs in Northern Districts of West Bengal. *Nat. Sem. Emerging Trends in Plant Taxonomy*, Nagpur University, October 20 – 21.

Sarkar Ajita, Das AP 2006. Mech's way of treating Pneumonia in the Northern Districts of West Bengal. *Nat. Sem. Env. Sustainable Develop.*, Raiganj College, Raiganj. P: 14.

Saxena AP, Vyas KM 1986. Antimicrobial activity of seeds of some ethnomedicinal plants. *J. Econ. Tax. Bot.* 8(2): 291 – 299.

Schultes RE 1941. A contribution to our knowledge of *Rivea corymbosa* the narcotic Olodoqui of the *Aztecs*. *Bull. Mus. Leaf. Harvard Univ.* USA.

Schultes RE 1956. The strange narcotic snuff of Eastern Columbia; their sources, preparation and effect on an American Botanist. *London News* 299: 520 – 521.

Schultes RE 1960. Tapping our heritage of ethnobotanical lore. *Econ. Bot.* 14: 257 – 262.

Schultes RE 1963. Plantae Colombianae – 16. Plants as oral contraceptives in the North West Amazon. *Lloydia* 26: 67 – 74.

Schultes RE 1967. The place of ethnobotany in the ethnopharmacologic search for psycoactive drugs. In Efron, D.(ed.) Ethnopharmacologic search psycoactive drugs . Washington: VSPHS Publ. No. 1945: 103 – 124.

Schultes RE 1987a. Ethnopharmacological conservationsw: A key to progress in medicine. *Opera Botanica* 92: 217 – 224.

Schultes RE 1987b. Cocoa and other psycoactive plants. Magico – religious roles in primitive societies of new World cocaine: Clinical and behavioral aspects. (Fisher, A. Raskin and E. H. Uhlennhuth (eds). 212 – 249. Oxford Univ. Press, New York.

Schultes RE 1988. *Where the Gods reign*. Synergetic Press, Oracle, Az.

Schultes RE 1990. The place of ethnobotany in the ethnopharmacologic search for psycotomimetic drugs. *Curare* 13(1): 31 – 46.

Schultes RE 1992. Unusual and promising aboriginal food plants of North Western Amazon. *Ethnobotany* 4: 7 – 24.

Schultes RE 1993. The virgin field in psycoactive plant research. *Ethnobotany* 5: 5 –61.

Schultes RE 1996. The plant kingdom – A thesaurus of biodynamic constituents. *Ethnobotany* 8: 2 – 13.

Sen R, Pal DC, Soren AM 1983. Traditional uses and ethnobotany of 'Kuchila' (*Strychnos nux-vomica*) *J. Econ. Tax. Bot.* 4(2): 575 – 578.

Seitel P [ed.] 2001. *Safeguarding Traditional Cultures: A Global Assessment, Centre for Folklife and Cultural Heritage*. Smithsonian Institution, Washington D.C.

Shah GL, Gopal GV 1985. Ethnomedical notes from the tribal inhabitants of North Gujrat (India). *J. Econ. Tax. Bot.* 6: 193 – 201.

Shah GL, Menon AR, Gopal GV 1981. An account of the ethnobotany of Saurashtra in Gujarat State, India. *J. Econ. Tax. Bot.* 2: 173 – 182.

Shah GL, Yadav SS, Badrinath V 1983. Medicinal plants from Dahanu forest division in Maharashtra State. *J. Econ. Tax. Bot.* 4: 141 – 151.

Sharma BD, Kulkarni BG 1980. Floristic composition and peculiarities of Dev Raies (Sacred Grooves) in Kolhapur district, Maharashtra. *J. Econ. Tax. Bot.* 1: 11 – 32.

Sharma BD, Malhotra SK 1984. A contribution to the ethnobotany of tribal areas in Maharashtra. *J. Econ. Tax. Bot.* 5(3): 533 – 537.

Sharma BD, Vyas MS 1985. Ethnobotanical studies on the ferns and fern allies of Rajasthan. *Bull. Bot. Surv. India* 27(1-4): 90 – 91.

Singh V, Pande RP 1980. Medicinal plant lore of the tribals of Eastern Rajasthan (India). *J. Econ. Tax. Bot.* 1: 137 – 147.

Sivananda 1958. *Home Remedies*. Jodhpur.

Spruce R 1908. Notes of a Botanist on the Amazon Andes 2Vol. London.

Strachey E 1852. Catalogue of the plants of Adjacent Portion of Garhwal and Tibet. 1 – 269. Lovel Reeve and Co., London.

Tarafder CR 1983a. Ethnogynaecology in relation to plants. Part I. Plants used for fertility and conception. *J. Econ. Tax. Bot.* 4: 483 – 489.

Tarafder CR 1984a. Ethnogynaecology in relation to plants. Part III. Plants used to accelerate delivery and pre and post natal complaints. *J. Econ. Tax. Bot.* 5(3): 572 – 567.

Thakre RP 1980. Studies on the antibacterial activity of some plant extracts. *Indian Drugs* 17(15): 148.

Thakre RP 1983. Antibacterial activity of the leaf extracts of some common plants. Ind. Sci. Congr. Abstracts. Pp. 36.

Tiwari KC, Majumdar R, Bhattacharjee S 1978. Some medicinal plants from Tirap district of Arunachal Pradesh, India. *J. Pharm. Sci.* 40: 206 – 208.

Tiwari KC, Majumdar R, Bhattacharjee S 1980. Folk lore claims of medicines and treatment from Assam. *Bull. Medico. Ethnobot. Res.* 1(9): 176 – 178.

Tripathi VD, Rastogi RP 1981. Flavonoids in biology and medicine. *J. Sci. Ind. Res.* 40: 116 – 124.

Tyler VE 1986. Plant drugs in twenty first century. *Econ. Bot.* 40: 279 – 288.

Vartak VD, Datar R 1975. Enumeration of wild edible plants from Karnala bird sanctuary, Maharashtra, India. *Biovigyanam* 1: 123 – 129.

Venkatram BS, Yoganarsimhan SN, Togunashi VS 1975. Sanjeevinee, its identity and therapeutic claims. *J. Res. Ind. Med.* 10(4): 92 – 95.

Waring EJ 1868. *Pharmacopoea of India*.. A.H. Wallen, London.

Waring EJ 1897. *Bazar Medicines and Common Medicinal Plants of India*. J. and A. Churchill, London.

Wicken GE 1993. Vegetation and ethnobotany of Atacama desert and adjacent Andes in Northern Chile. *Opera Botanica* 121(9): 291 – 307.

Yonzan MK, Bhujel RB, Yonzone GS 1987. *Astilbe rivularis* Buch.- Ham. Sxifragaceae), a potential medicinal plant growing wild in Darjeeling Himalaya. *Herba Hungarica* 26 (1): 87 - 88, Hungary

Yonzone GS, Bharati P, Yonzan B & Bhujel, R.B.1985. Ethnomedicinal plants of Darjeeling –Sikkim Himalayas *J. Intel. Hort. Soc.* (Spl. Issue) Pp. 193 - 202.

Yonzone GS, Yonzone A, Bhujel RB 1996. Contribution to the ethnobotany of Darjeeling District (India). *Abstr. IV Intn. Cong. Ethnobiol.* Pp.388 - 389. Lucknow.

Yonzone GS, Yonzone DKN, Tamang KK 1984. Medicinal plants of Darjeeling district. *J.. Econ. Tax. Bot.* 5(3): 605 - 616.

Yonzone R, Mandal S 1982. A preliminary Report on the ethnobotanical survey of Kalimpong in Darjeeling District, West Bengal, *J. Beng. Nat. Soc. n.s.* 1 (1): 96-99.

Yonzone R, Mandal S, Chanda S 1981. A contribution to the ethnobotany of Darjeeling Hills. *Trans. Bose Res. Inst.* 44(3): 74 - 81.