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North-East India an Ethnic Storehouse of Unexplored Medicinal Plants

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ABSTRACT

North East states of India are one of the richest repositories of medicinal and aromatic plants in the World. This region is also well-known for diverse culture of human races and home of large number of ethinic people of India. The age long intrinsic relationship between this ethinic people with the environmental resources mainly plants endued the modern civilization with many herbal medicines, though a large number of medicinal plants and their folk uses have remained endemic to certain tribes of the region. Scientific approach for their exploration, utilization, conservation and value addition may be the key points for entrepreneurship development by exploiting the indigenous technology knowledge. The therapeutic activity of such plants has made an outstanding contribution in the origin and evolution of many traditional herbal therapies, but such folk traditional knowledge have started to disappear with the passage of time due to scarcity of written documents and relatively low income in these traditions. Though the ethanobotanical survey is a very intricate or convoluted process, but a more number of ethanobatanical surveys, and assembly of such information in systemic way can make difference in research and development work on such medicinal plants. This type of approach also helpful for conservation programme of rare plant species.

Keywords: North East India; Medicinal plants; Tribes; Traditional knowledge; Ethanobotanical Survey.

INTRODUCTION

North-eastern states of India, flanked in the north by the Himalayas and in the south by the Bay of Bengal, constitute a characteristic narrow passageway that connects the Indian subcontinent to East Asia and Southeast Asia. The landlocked northeast region of the country comprises eight separate states namely Arunachal Pradesh, Assam, Mizoram, Manipur, Meghalaya, Nagaland, Tripura and Sikkim. The immense variety of the climatic, edaphic and altitudinal variations in North-eastern India have resulted in a great range of ecological habitats. Northeast India characterizes the transition zone between the Indian, Indo-Malayan and Indo-Chinese

biogeographic regions and a meeting place of the Himalayan Mountains and Peninsular India, and it was the part of the northward migrating 'Deccan Peninsula'. [1] The lushness of its landscape, favourable climatic condition, the range of communities and geographical and ecological diversity makes the North East part of India quite different from other parts of the subcontinent. Northeast India is therefore the geographical 'gateway' for much of India's flora and fauna, and as a consequence, the region is one of the richest areas of India in biological values. [2,3] The north eastern region has been in spotlight for its high biodiversity and traditional knowledge, and this region has been a priority for leading conservation agencies of the world. The region is affluent in medicinal plants and many other rare and endangered taxa. High endemism in higher plants, vertebrates and avian diversity in this region has qualified it to be a biodiversity 'hotspot'. [4] A large number of ethinc people or tribe are also inhabited in this part of India. Tribes also posses a vast traditional knowledge on effective herbal medicines, which was acquired through the experience, are usually passed on by oral traditions as a guarded secret of certain families. Thus, the potentialities of ethnomedicinal studies in North East should be given the importance as it can provide us a lead to discover of more and potential useful chemical compounds. [5,6] Their identification, conservation of medicinally important plant species, traditional knowledge is absolute requirement for our time. Although several ethnomedicinal survey on North eastern India has been carried out by different researcher, but still it is believed that use of different plant for health care is trapped in the remote area of the region. A detailed and systematic review on ethnobotanical study in the North East region is required as this may provide a meaningful way for the protection of the traditional knowledge and medicinal plant, and use this information for future research.

AREA AND LOCATION

North East India comprising the states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. The region has a total geographical area of 262179 km^2 (about 8% of the total area of India) and lies between 21°34′ N to 29°50′ N latitude and 87°32′ E to 97°52′ E longitudes. [3] Arunachal Pradesh is the largest state, having 83,743 km^2 area while Sikkim is the smallest state of the region with the geographical area of 7,098 km^2. North eastern India stretches from the foothills of the Himalayas in the eastern range and is surrounded by Bangladesh, Bhutan, China, Nepal and Myanmar.

TOPOGRAPHY AND CLIMATE

North eastern region of India is characterized by diverse physiography, ranging from plains, plateaus, mountains and valleys. Geographically this region can divided into three types, viz. (i) Meghalaya plateau (ii) North-eastern hills and basin and (iii) the Brahmaputra valley. [1,3,4] The states receive moderately to high rainfall and the average minimum and maximum rainfall are 1650 mm and 6320 mm, respectively. The maximum (about two third) annual rainfall in the region is received during the monsoon months of April-September and temperature ranging between below 0°C to high upto 38°C. Northeast India enjoys diverse climatic condition with predominantly humid sub-tropical climate with hot, humid summers, severe monsoons and mild winters. Arunachal Pradesh and Sikkim situated near Himalaya and have a montane climate with cold, snowy winters and mild summers. While other states of the regions has topical climate with high humidity, low to moderate temperature. According to climatic condition North-eastern India can be divided into two climatic zones *viz.*(i) Alpine or Montane zone (with cold snowy winters and mild summers): Arunachal Pradesh and Sikkim, and (ii) Humid subtropical (with hot humid summers severe monsoon and mild-medium winters): rest of the North-eastern states. [1,3,4]

BIODIVERSITY SIGNIFICANCE

The north eastern India has been in focus for its rich biodiversity. The affluence of the region's avifauna largely reflects the diversity of habitats associated with a wide altitudinal range. Northeast India symbolizes transition zone between the Indian, Indo-Malayan and Indo-Chinese biogeographic provinces and a meeting place of the Himalayan Mountains and Peninsular India. It was the part of the northward migrating 'Deccan Peninsula' and consider as the geographical 'gateway' for much of India's flora and fauna, and as a consequence, the region is one of the richest in biological values. It is in this lowland-highland evolution zone that the highest diversity of biomes or ecological communities can be found, and species varieties within these communities are also tremendously high. Northeast India is blessed with a large range of physiography and ecoclimatic situation. Northeast India forms a variety of tropical forests, especially the species-rich tropical rain forests, after the Andaman and Nicobar Islands and the Western Ghats in India. This part also consider as an important part of the Indo-Myanmar biodiversity hotspot, one of the 25 global biodiversity hotspots acknowledged currently. Table 1 listed total area, forest cover area and plant diversity of northeastern states. Some of the important biodiversity significance is listed below. [1,3,4,6-10]

- 6 important vegetation types out of the 9 of India found in the North Eastern region.
- More than 8,000 out of 15,000 species (in India) of flowering plants found in the North Eastern region, which includes 40 species of gymnosperms, 500 species of pteridophytes, 825 species of orchids, 80 species of rhododendrons, 60 species of bamboo, and 25 species of canes.
- A total of 3,624 species of insects, 50 molluscs, 236 fishes, 64 amphibians, 137 reptiles, 850 birds and 160 mammalian species have been so far reported, but still a lot of species yet to describe.
- Three families of primates' occur in India with 15 known species, 9 of these species found in North east India.
- Out of the 6 largest cats of the world recorded from India, northeaster region sustain four of them, and the Indian population of the Clouded Leopard is mainly restricted to the Northeastern region.
- 51 different types of forest are found in the region, which includes tropical moist deciduous forests, tropical semi evergreen forests, tropical wet evergreen forests, subtropical forests, temperate forests and alpine forests.

ETHNIC DIVERSITY AND INDIGENOUS KNOWLEDGE

Apart from the unique natural diversity, this parts of India also a classic example of 'unity in diversity' for the entire country. A large number of indigenous and immigrant ethnic and tribal groups are inhibit in this region with bewildering physical and cultural features. More than 200 different tribes with district dialect, custom, belief, heritage and socio-religious tradition settled in the north eastern states. It is believed that this part of India used as crucial corridor for human migrations including, perhaps, the first migrations from Africa towards East Asia and Australia more than 40,000 years ago. [1,3]

Ethnic communities have always generated, refined and passed on traditional knowledge from generation to generation. This knowledge is based on their needs, instinct, observation, trial and error and long experience. Such knowledge is often an important part of their cultural identities. Traditional knowledge has played, and still plays, a vital role in the daily lives of those people. Traditional knowledge is essential to the food security, shelter, ritual and healthcare system. A large number of ethnic people are still live on remote forests and hills. Agriculture through 'Jhum' of 'Shifting' cultivations is the main occupations of the people. They are highly dependent on natural resources including forests. The distinct tribes of the region have their own

and rich traditional knowledge and utilizing environment in daily life. The knowledge and mode of utilization of local plants varies with ethnic groups. The use of medicinal plants plays a very vital role in their health care of tribal people. [3,5] Table 2 listed different tribes of North-eastern states.

ETHANOBOTANICAL SURVEY

Ethinic and tribal people possess a great deal of indigenous knowledge arising from their utilization of natural resources. They are aware of the extent of variation as well as the traits displayed by individual trees. Utilization of this knowledge is valuable in research and development. The information that local communities possess about their natural resources like how plants are used, how plant resources are distributed across the ecosystems they manage, the classification and identification of plant diversity, and the relationships between plants, people and animals in their ecosystem are very important for conservation of plant and traditional knowledge. [3,5,10] Ethnobotanical information which emanates from ethnobotanical and socio-economic surveys and literature reviews often represents the indigenous knowledge of ethnic/tribal/local people. Therefore documentation of this type of information can guide the researcher to identify new drug molecule and also can help in addressing intellectual proper right issues.

Since after 1970's different researchers, university, research institutes has been working on ethanobotany and traditional knowledge. [3] In last few years the research and documentation of traditional knowledge of north eastern state has increased but still it is not sufficient. Compare to rest of India the number of survey is very less though it is a vast source of indigenous knowledge, and a lot of information about plants, their medicinal uses, ethanobotany still trapped into certain areas of North eastern India. Therefore a lot of survey needs to be carry out to explore our traditional and indigenous knowledge. Table 3 listed some of the ethanobotanical survey of North eastern states.

IMPORTANCE AND CONSRVATION OF MEDICINAL PLANTS

There is an increasing focus on the importance of medicinal plants and traditional health systems in solving the health care problems of the world. North east India represents an extremely unique eco-system rich in medicinal plant wealth associated with Folk medicine, Ayurveda, Siddha, Amchi, Unani and Homeopathy system of medicines. Among these many species of medicinal plant North-east origin have revolutionized the allopathic systems of medicine. The medicinal plants also have traditionally engaged an important position in the socio-cultural, spiritual and medicinal arena of the people in the region. Medicinal plants play an important role in supporting rural healthcare system in India. According to the World Health Organization (WHO), 80% of the rural population in developing Asian and African countries utilizes locally available medicinal plants for their primary healthcare needs. About 90% of the medicinal plants of India are found in forest habitats, while only 10% of the medicinal plants are distributed among other landscape elements like open grasslands, agricultural pastures, waste land and in and around fresh water bodies, etc. Traditional medical practice is an integral part of culture of people of North East India. In spite of this condition traditional health care systems suffered a setback during modern civilization, industrialization and lost patronage particularly in urban areas. There is a mounting focus on the importance of medicinal plants and traditional health systems in solving the health care problems of the world. Herbal products are gaining global owing in this modern, busy and polluted environment. Traditional herbal medicine, supplements and cosmetics are better than synthetic components; as they are cost-effective, easily available, better compatible with physiological flora, and most importantly have negligible side effects. Because of this awareness, demand of herbal product increasing and the international trade in plants of

medical importance is growing phenomenally, often to the detriment of natural habitats and mother populations in the countries of origin [1,3,5]. Therefore the need of the hour is to harness this natural resource sustainably for the socio-economic development of the local and indigenous people while protecting the biodiversity at the same time. The strategies like cultivation of medicinal plants combined with sustainable collection practices from the wild would be useful in achieving this goal. In the 21st century, conservation, sustainable use of medicinal plants of North East India will contribute to self-reliance of millions for India's own health needs and has global relevance. Some of the important medicinal plants of Northeaster India include *Abrus precatorius* L. (Papilionaceae), *Adhatoda vasica* L. (Acanthaceae), *Aegle marmelos* (L.) Correa (Rutaceae), *Albizia lebbeck* Benth. (Mimosaceae), *Andrographis paniculata*_Burm. f. Wall. (Acanthaceae), *Azadirachta indica* A. Juss. (Meliaceae), *Averrhoa carambola* (Oxalidaceae), *Cajanus cajan* L. (Fabaceae), plants under *Cassia* sppecies (Caesalpiniaceae), *Centella asiatica* (L.) Urban (Apiaceae), *Clerodendrum viscosum* L. (Verbenaceae), *Cratoxylum neriifolium* Kurz. (Hypericaceae), *Coccinia grandis* L. (Cucurbitaceae), *Curcuma aromatica* L. (Zingiberaceae), *Cuscuta reflexa* Roxb. (Cuscutaceae), *Dillenia indica* L. (Dilleniaceae), *Eichhornia crassipes* (Mart.) Solms (Pontederiaceae), *Galinsoga parviflora* Cav. (Asteraceae), *Gynocardia odorata* R. Br. (Flacourtiaceae), *Hedyotis auricularia* L. (Rubiaceae), *Hippeastrum puniceum* (Lam.) Urb. (Amaryllidaceae), *Ichnocarpus frutescens* R.Br. (Apocynaceae), *Kalanchoe pinnata* (Lam.) Pers. (Crassulaceae), *Lantana camara* L. (Verbenaceae), *Leea asiatica* L. (Liliaceae), *Leea indica* (Burm. F.) Merr. (Liliaceae), *Litsea glutinosa* Lour. (Lauraceae), *Marsilea minuta* L. (Marsileaceae), *Meyna spinosa* Roxb. (Rubiaceae), *Murraya paniculata* L. (Rutaceae), *Oxalis corniculata* L. (Oxalidaceae), *Phyllanthus acidus* L. (Euphorbiaceae), *Phyllanthus emblica* L. (Euphorbiaceae), *Santalum album* L. (Santalaceae), *Strobilanthes cussia* Nees. (Acanthaceae), *Smilax zeylanica* L. (Smilacaceae), *Spilanthes paniculata* (Asteraceae), *Stephania japonica* (Thunb.) Miers (Menispermaceae), plants under *Terminalia* species (Combretaceae), *Urena lobata* L. (malvaceae), *Vernonia cinerea* Less.(Asteraceae), *Vitex peduncularis* Walls (Verbenaceae), *Withania somnifera* L. (Solanaceae), *Zanthoxylum armatum* DC. (Rutaceae) etc.

FUTURE PROSPECTIVES

Traditional knowledge considered as a body of information and set of skills developed by a group of people over time, which is based upon their necessity, observation; and in a constant state of change. The information about folk medicine of North East India are still not gathered in systemic way or not documented in old literature, these are generally passed over generation vocally. In order to consider the "preservation" of traditional knowledge, perhaps it need documentation of those old and useful literature and to explore the nature of this system, how it evolves over time, and identify some of the forces involved in its destruction. The documentation of traditional knowledge is useful to address the intellectual property right issues and for evidence based research work. Multidisciplinary research and development work using the traditional folk medicinal plants based upon their traditional knowledge can provide deep motivation for identification of new pharmacophores. Besides escalating the herbal therapeutic and preventive armamentarium, new pharmacophores may help to evolve new targets of drug action as well as a possibility for on the novel pharmacophores. Newer approaches utilizing collaborative, multidisciplinary research and recent technology in combination with established traditional health principles will yield wealthy dividends in the near future in improving healthcare worldwide.

Table 1: Area, climatic condition, plant diversity in North Eastern states of India

States	Total area (sq. km.)	Forest covers (%)	Climatic condition	Plant diversity specification
Arunachal Pradesh	83,743	80.43%	Annual rain fall: 1500-3750 mm. Temperature: 0 to 31ºC	Flowering plants around 5000 species, but 238 are endemic to the state. The state rich with 500. Species of orchids
Assam	78,438	35.30%	Annual rain fall: 2000-8000 mm. Temperature: 5 to 32ºC	Flowering plants around 3010 species, from which 102 species are endemic. State is rich in bamboo diversity (42 species)
Manipur	22,327	77.4%	Annual rain fall: 1250-2700 mm. Temperature: 14.5 to 38ºC	Flowering plants around 2500 species
Meghalaya	22,429	77.23%	Annual rain fall: 4000-11,436 mm. Temperature: 2 to 33ºC	Flowering plants around 3500 species
Mizoram	21,081	91.27%	Annual rain fall: 2160-3500 mm. Temperature: 11 to 29ºC	Flowering plants around 2200 species
Nagaland	16,579	81.21%	Annual rain fall: 2000mm. Temperature: 4 to 30ºC	Flowering plants around 2250 species
Sikkim	7,096	82.31%	Annual rain fall: 2700-3200mm. Temperature: 0 to 28ºC	Flowering plants around 4500 species
Tripura	10,491	76.95%	Annual rain fall: 2250-2500mm. Temperature: 4 to 38ºC	Flowering plants around 1600 species, of which 14% of species found is endemic

Table 2: Geographical location and tribes of North Eastern states of India

State	Location	Population	Location (Major Tribes)
Arunachal Pradesh	latitude 26° 30' N and 29° 30 ' N and longitude 91° 30' E and 97°30' E	1,382,611	Adi, Mongpa, Lispa, Chugppa, Nyishi, Aka, Aptani, Bangani, Khamba, Khowa, Memba, Miji, Hill Miri, Mishing Miri, Sherdukpen, Sulung, Singpho, Tagin, Tangsa, Wancho, Yobin (Lisu), Zakhring (Meyor), Idu mishmi, Mishmi, Khampti, Nocte, Bugun, Galo, Hrusso, Koro, Monpa, Sajolang, Sartang, Tai Khamti, Khamba, Memba.
Assam	latitude 24° to 28° North & longitude 90° to 96° East	31,169,272	Chakma, Dimasa, Garo, Hajong, Hmar, Khasi, Jaintia, Synteng, Pnar, War, Bhoi, Lyngngam, Kuki tribes (Baiate, Changsan, Chongloi, Doungel, Gamalhou, Gangte, Guite, Hanneug, Hao Kip, Hanpit, Lhonyem, Lhocwun, Lupheng, Mangje, Misao,) Riang, Sairhem, Selnam, Singson, Haolai, Hengna, Hongsungh, Hrangkhwal, Raokhol, Tongbe, Khawathlang, Khothalong, Khawchung, Khelma, Kholhou, Kipgen, Kuki, Lengthang, Lhangum, Lhoujem, Lhouvum, Misao, Riaong, Sairhem, Selnam, Singsom, Sithou, Sukto, Thado, Thangngeu, Uibush Vaiphel), Lakher, Man (Tai speaking), Any Mizo (Lushal) tribes, mikir, Any Naga Tribes, Pawi, Syntheng. Barmans in Cachar, Boro, Borokachari, Deori, Hajong, Kachari, Sonwal, Lalung, Mech, Miri, Rabha
Manipur	latitude 23.83^{0}N to 25.68^{0}N & longitude 93.03^{0}E to 94.78^{0}E	2,721,756	Aimol, Anal, Angami, Chiru, Chethe, Gangte, Hmar, Kabui, Kacha Naga, Koirao, Koireng, Kom, Lamgang, Mao, Maram, Maring, Any Mizo (Lushai) tribes, Monsang, Moyon, Paite, Purum, Ralte, Sema, Simte, Suhte, Tangkhul, Thadou, Vaiphui, Zou.
Meghalaya	Latitude 20° 1' N & 26° 5' N, Longitude 85° 49' E & 92° 53' E	2,964,007	Bhoi, Boro, Chakma, Dimasa, Garo, Hajong, Hmar, Ja;intia, Karbi (Mikir), Khasi, Koch, Kuki, Lakher, Lyngngam, Man (Tai speaking), Mizo (Lushai), Naga, Pawi, Pnar, Rabha, Synteng, War.
Mizoram	Latitude 21^o 58' & 24^o 35' N Longitude 92^o 15' & 93 ^{o} 29' E	1,091,014	Chakma, Dimasa Kachari, Garo, Hajong, Hmar, Khasi, Jaintia, War, Any Kuki (Baiate, Changsan, Chongloi, Doungel, Gamathou, Gangte, Guite, Hanneu, Hao Kip Hanpit, Lhonyem, Lhocwun, Lupheng, Mangje, Misao Riang, Sairhem, Selnam, Singson, Haolai, Hengna, Hongsungh, Hrangkhwal, Raokhol, Tongbe, Khawathlang, Khothalong, Khawchung, Khelma, Kholhou, Kipgen, Kuki, Lengthang, Lhangum, Lhoujem, Lhouvum, Misao, Riang, Sairhem, Selnam, Singsom, Sitlhou, Sukto, Thado, Thangngeu, Uibush, Vaiphei), Lekher, Man (Tai speaking), Any Mizo (Lushai tribe), Karbi, Any Naga tribe, Pawi.
Nagaland	25°6' and 27°4' latitude, North of Equator and between the longitudinal lines 93°20'E and 95°15'E		Lotha, Phom, Pochury, Rengma, Sumi, Sangtam, Yimchungru, Zeliang, Ngami, Ao, Chakhesang, Chang, Khemungan, Konyak, Lotha, Phom, Pochury, Rengma, Sangtam, Sema, Yimchunger and Zeliang. Adi, Aka, Dimasa, Galong, Garo, Khasi and Jaintia, khowa, Kuki, karbi (Mikir), Mizo. Any Naga tribe (Ao, Angami, Chakhesang, Chang, Chiru, Khiemnungan, Konyak, Lotha, Makwari, Phom, Rengma, Sangtam, Sema, Tikhir, Yimchungree, Zeliang), Syntheng, Momba.
Sikkim	27°04' and 28°07' latitude, North of Equator and between the longitudinal lines 88°00'E and 88°55'E	607,688	Lepchas, Bhutias and Nepalese.
Tripura	It lies on latitudes 22°56' and 24°32' N and longitudes 91°09' and 92°20' E.	36,71,032	Tripuri, Jamatia, Bhil, Reang, Noatia, Bhutia, Chakma, Chaimal, Garo, Halam, Khasia, Kuki, Lepcha, Lushai Mag, Munda, Kaur, Orang, Santhal and Uchai

Table 3: List of ethnobotanical survey in North Eastern states of India

Year	Author	Study Location	No of plants reported	Remarks
2005	Kala[11]	Ziro valley of Lower Subansiri, Arunachal Pradesh	158	plants used by the Apatani tribe
2006	Ali and Ghosh[12]	West Siang, East Siang and Upper Siang, Arunachal Pradesh	19	plants used by the Adi community
2007	Bhuyan[13]	Arunachal Pradesh	50	plants are used by different tribes of the state
2008	Sen *et al.*[14]	Lohit, Arunachal Pradesh	37	plants used by the Khamptis community
2009	Goswami *et al.*[15]	Daparijo, Arunachal Pradesh		plants are used by Tagin tribes of the state
2010	Doley *et al.*[16]	Doimukh, Tigdo, Karsingsha, Chimpu and Ganga village, Arunachal Pradesh	15	these species are very rarely known for medicinal property in the region and used by Nyshi community
2010	Panda and Srivastava [17]	West Kameng, Arunachal Pradesh	7	plants are used by Aks, Nepalese and Dirang Monpas communities
2011	Tangjang *et al.*[18]	Tirap, Papum Pare and Lower Dibang Valley, Arunachal Pradesh	74	plants are used by the ethnic groups namely Nocte, Nyishi and Adi in Eastern Himalayan region
2006	Saikia *et al.*[19]	Assam	85	plants are used to cure different skin ailments and also as cosmetics
2006	Sajem & Gosai[20]	North Cachar Hills, Assam	39	plants are use by the indigenous Jaintia tribes
2007	Buragohain & Konwar 12	Upper Assam,	68	plants are used by Indo-Mongoloid communities in various skin diseases
2008	Buragohain [21]	Tinsukia district, Assam	24	ethnomedicinal plants used in the treatment of gynecological disorders
2008	Das *et al.*[22]	Cachar District, Assam	107	plants are used by tribal and non tribal people of that locality in daily life
2008	Sikdar & Dutta[23]	Raja mayang village, Assam	62	plants are used by indigenous Nath community
2009	Borah *et al.*[24]	Lakhimpur & Sonitpur, Assam	12	plants or their parts are used in the treatment of diabetes in alone or in combination
2010	Dutta Choudhury *et al.*[25]	Barak Valley, Assam	26	antipyretic plant species are use by the Manipuri community of Barak valley
2010	Gogoi and Islam[26]	Upper Brahamaputra valley, Assam	49	plants were practiced traditionally by the local inhabitants of the area
2010	Saikia *et al.*[27]	Gohpur, Assam	20	plants are used by Bodo tribes in that region
2011	Choudhury *et al.*[28]	Cachar , Assam	24	plants have poisonous property and also useful in medicinal purpose
2011	Namsa *et al.* [29]	Sonitpur, Assam	22	plants are used for their anti-malarial property
1999	Singh *et al.*[30]	Tripura	37	wild edible plants used by the Tripuri tribes
2006	Majumdar *et al.*[31]	Tripura	33	ethnomedicinal plants used by non-tribal and tribal medicine men
2006	Sankaran *et al.*[32]	Tripura	40	fruits of those plants are usually taken by the rural people
2007	Majumdar and Datta[33]	South & West Tripura, Tripura	50	plants are commonly prescribed by traditional people
2009	Das *et al.*[34]	Tripura	33	plants are used by Tripuri and Reang tribes
2009	Shil and Dattu Choudury[35]	Tripura	16	which are usually used the Reang community
2009	Shil and Dattu Choudury[36]	Dhalai district, Tripura	58	the collected plants are commonly used by the tribes of Tripura
2010	Das and Datta Chaudhury[37]	North Tripura district, Tripura	26	commonly used by Halam, Tripuri and Chakma Tribe of North Tripura
2010	Das *et al.*[38]	Tripura	63	popularly used by the Tripuri, Reang, Jamatia, Lusai, Halam, Mog, Chakma and others tribes of
2011	Sen *et al.*[39]	South & West district, Tripura	113	plants are used by local tribes inhabited in that area
2004	Dolui *et al.* [40]	Ri-Bhoi and Jaintia Hill, Meghalaya	46	plants are used by Garo, Khasi Jaintia
2005	Agrahar-Murugkar and Subbulakshmi [41]	Khasi hills of Meghalaya	7	these are seven wild edible mushrooms commonly having nutrition values
2006	Laloo[42]	Meghalaya	80	these medicinally important woody species were identified from Swer and Mairang sacred groves
2007	Sawian *et al.*[43]	Meghalaya	249	these are wild edible plant of the state
2008	Hynniewta and Kumar[44]	Ri-Bhoi, West and East Khasi Hill, Meghalaya	54	plants are used by Khasi traditional healers
2010	Chhetri[45]	Khasi, Garo and Jaintia hills, Meghalaya	19	plants are used by Khasi, Garo and Jaintia tribes
2005	Khumbongmayum[46]	Manipur	120	These plants are used to treat skin disorders, ulcer, rheumatism, bronchitis etc.
2005	Singh and Singh[47]	Manipur	20	Meitei community are using these plants in daily life to cure 29 diseases or aliments

2008	Devi and Pattanayak[48]	Manipur	4	these 4 varieties of rice used for treatment of nine ailments of human being
2010	Khan and Yadava[49]	Thoubal, Manipur	44	local practitioners of Meitei, Meitei-pangal and Loi communities are using these plant to cure asthma.
2010	Khan and Yadava[50]	Thoubal, Manipur	54	plant species are used to treat diabetes by different ethnic communities in the district.
2011	Sharma *et al.* [51]	Manipur	33	theses are different ginger species used by ethnic people of Manipur as food, traditional medicine and as ornamental plants
2011	Yumkham, and Singh[52]	Manipur	20	Among these 20 ferns and fern allies 4 are used as food and 5 as medicine
2001	Sharma *et al.* [53]	Aizawl dist, Mizoram	135	These plants are used not only for medicinal purpose most of them also used as food.
2005	Bhardwaj and Gakhar[54]	Mizoram	17	Plants are specially used to treat cut and wounds
2007	Lalfakzuala *et al.*[55]	Mamit district, Mizoram	89	Among them 23 species are easily available and used as folk medicine. The plants also used as food and other purposes.
2010	Rai and Lalramnghinglova[56]	Mizoram	159	Plants are used in the daily life of people of Mizoram and have folk medicinal uses.
2010	Rai and Lalramnghinglova[57]	Mizoram	57	The ethnomedicinal uses of these plants are less known and used by the ethinic people of the state.
2002	Singh *et al.* [58]	Sikkim	64	Plants are used the ethnic groups of the states
2004	Maity *et al.*[59]	North Sikkim	15	tuber, rhizome, roots of these plants used by Lapchas, Nepalis and Bhutias as folk medicine.
2007	Hussain and Hore[60]	Sikkim and Darjeeling (West Bangal)	28	theses are indigenous medicinal plants used by ethnic communities
2007	Chanda *et al.* [61]	Sikkim	36	plants are used to treat gastrointestinal disorders
2008	Pradhan *et al.*[62]	North Sikkim	118	plants are used by Lepcha tribe to treat approximately 66 aliments.
2010	Bharati and Sharma[63]	Sikkim	19	ethnic group of the states using these plants in their daily life
2010	Panda and Misra[64]	Sikkim	31	plants are used Lepcha, Bhutia, and Nepalis for treatment of several diseases
2011	Lepcha *et al.* [65]	East Sikkim	25	Ethnic group of the states using these plants in their daily life
1982	Rao and Jamir[66]	Nagaland	51	Theses medicinal plants are used by the Aos tribe in Nagaland
1999	Jamir *et al.*[67]	Nagaland	35	tribal group of the states using these plants
1999	Changkija[68]	Nagaland	109	Different ethnic people (14 tribes) of Nagalang using these plants to treat different aliments
2010	Jamir *et al.*[69]	Nagaland	55	Theses medicinal plants are used by the Lotha-Naga tribes of the state

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