

Biodiversity of India: Tribal People and their Livelihoods

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Introduction

Biodiversity, a contraction of "biological diversity," generally refers to the variety and variability of life on Earth. One of the most widely used definitions defines it in terms of the variability within species, between species, and between ecosystems. It is a measure of the variety of organisms present in different ecosystems. This can refer to genetic variation, ecosystem variation, or species variation (number of species) within an area, biome, or planet. Terrestrial biodiversity tends to be greater near the equator, which seems to be the result of the warm climate and high primary productivity. Biodiversity is not distributed evenly on Earth. It is richest in the tropics. It is an essential component of nature and it ensures the survival of human species by providing food, fuel, shelter, medicines and other resources to mankind. The richness of biodiversity depends on the climatic conditions and area of the region. All species of plants taken together are known as flora and animals known as fauna.

Biodiversity is not evenly distributed; rather it varies greatly across the globe as well as within regions. Among other factors, the diversity of all living things (biota) depends on temperature, precipitation, altitude, soils, geography and the presence of other species.

Biodiversity provides critical support for drug discovery and the availability of medicinal resources. A significant proportion of drugs are derived, directly or indirectly, from biological sources: at least 50% of the pharmaceutical compounds on the US market are derived from plants, animals, and micro-organisms, while about 80% of the world population depends on medicines from nature (used in either modern or traditional medical practice) for primary healthcare

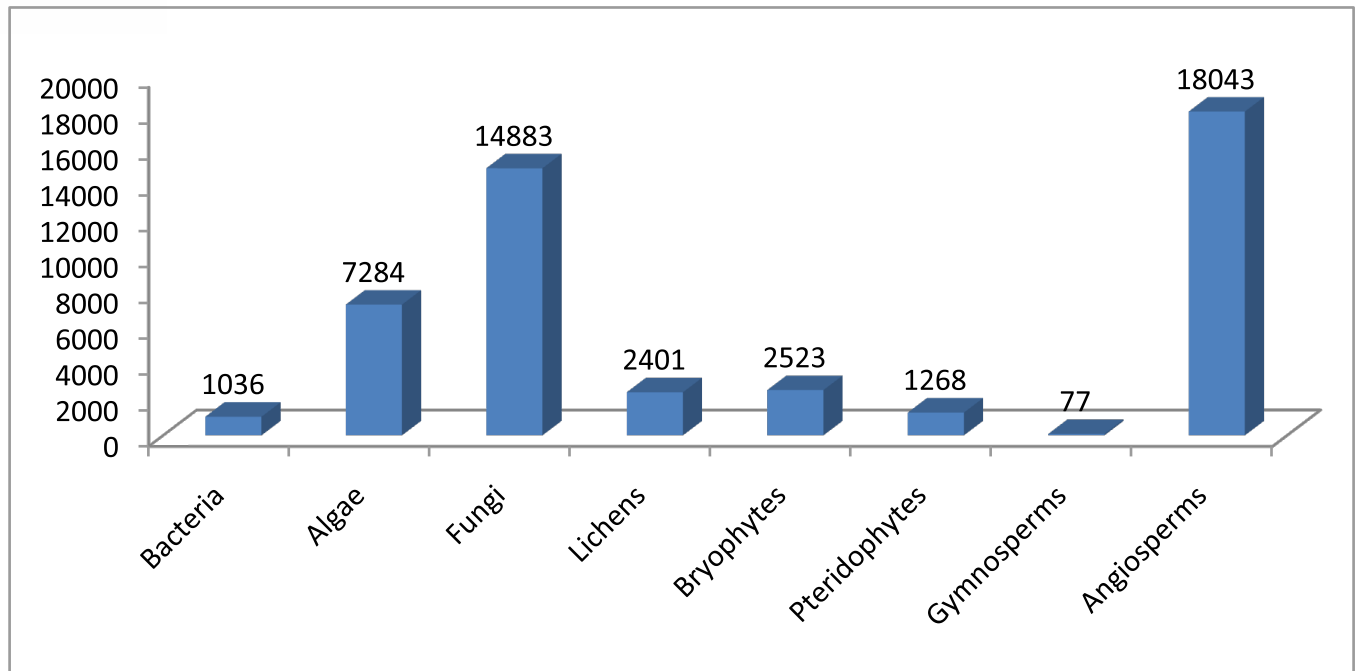
Biodiversity of India

The India is rich in biodiversity due to diversified climatic conditions that vary from the humid tropical Western Ghats and the hot desert of Rajasthan to diversified north east regions of the country, from the cold desert of Ladakh and the icy mountains of Himalaya to the warm coasts of Peninsular India, and the central fertile plains providing innumerable microhabitats. It is second largest country in the world in respect of population and 7th largest country in the world in area & 2nd largest in Asia. Occupied 7th ranks in the world in contribution of agricultural plants, 10th largest mega diversity country in the world and 4th largest country in Asia. It constitutes 2.4% land area in the world, containing 17.5% human population and 15% biodiversity. It has 18% Livestock population, 50% Tiger population, 60% Elephants population, 62% Amphibian species, 50% Lizards, 10% Bamboo, 50% Aquatic flowering plants and 7% Mangroves of the world occur in India.

India harbors more than 47515 plant species including lower plants. Out of which 18043 (38.01%) are flowering plants which represent more than 7 % of the known flowering plants of the world (Singh *et al*, 2015). Of these 5725 (33%) plants are endemic, confined to a restricted Indian boundary (Nayar 1996). About 1800 (10%) species of flowering plants are threatened. There is 2560 tree species (15%) occur in India. Out of 34 hotspots of the world, two hotspots viz. Western Ghats and Eastern Himalaya are found in India. It has been the centre of origin of cultivated plants.

Phytodiversity of India

There are about 47515 species of plants are found within Indian boundary. Out of which 1036 species of Bacteria, 7284 species of Algae, 14883 species of Fungi, 2401 species of Lichens, 2523

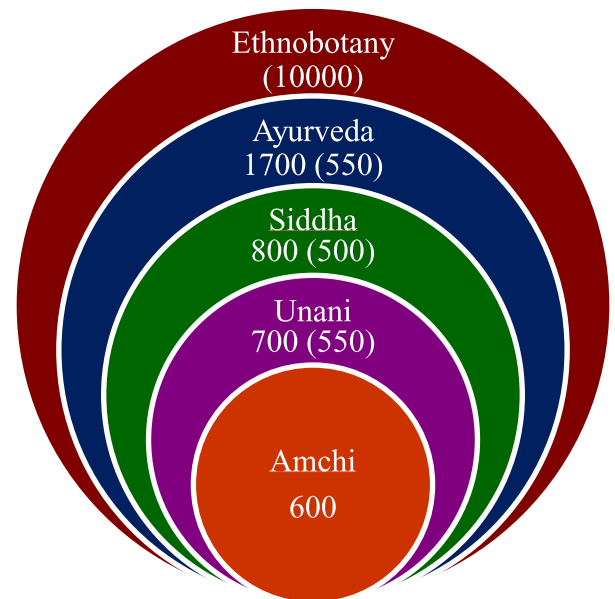


species of Bryophytes, 1268 species of Pteridophytes, 77 species of Gymnosperms and 18043 species of Angiosperms. These species are found in different life forms and various habitat conditions.

Indian System of Medicines

India has a glorious tradition of health care system dating back to several millennia. During the Vedic period and then the Samhita period, India had evolved highly sophisticated and codified systems with written treatises like Ayurveda and Siddha systems of medicine. The Indian systems of medicines functions mainly through two social streams:

- 1. Classical Stream:** This comprises of codified and organized medicinal wisdom with sophisticated theoretical foundations and philosophical explanations expressed in several classical texts like *Charak Samhita*, *Susruta Samhita*, *Bhel Samhita* and hundreds of other treatises covering all branches of medicine and surgery. Systems like Ayurveda, Siddha, Unani, Amchi are expressions of these classical streams. Plant species used in different classical systems is given below.

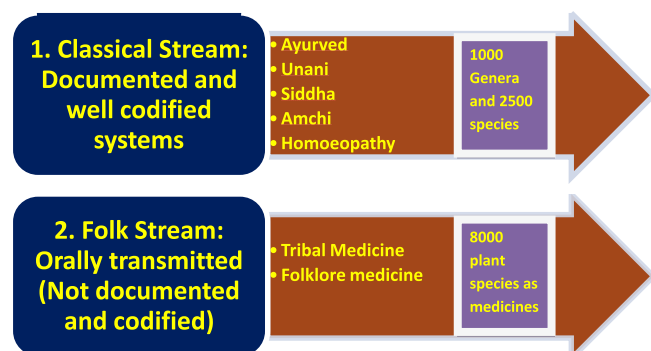


- 2. Folk Stream:** This folk stream flow in two parallel directions i.e. (a) through rural villagers and (b) through tribal communities
(a) *Through Rural Villagers:* This folk stream comprising mostly the oral traditions practiced by the rural villagers. The carriers of these



traditions are millions of housewives, thousands of traditional birth attendants, treatment of snake bites and traditional village physicians/ herbal healers, the vaidyas. These streams of inherited traditions are together known as local health traditions.

(b) *Through Tribal Communities:* This level of folk medicine which exists purely as oral traditions practiced by the tribal communities who inhabit in and around the forests. This tradition is currently fast eroding due to the change of life style of the tribal people.



Cultural Diversity (Tribal Communities)

India has over 84.3 million tribal people belonging to 550 communities of 227 ethnic groups as per the classification made by anthropologists on linguistic basis. They inhabit in about 5000 forested villages. Each tribal community has a distinct social and cultural identity of its own and speaks a common dialect. There are about 116 different dialects and 227 subsidiary dialects spoken by tribal's of India. With great antiquity the rich and varied culture the colourful traditions of tribal's add to the texture and luster of the great civilization and the heritage of India.

India is the land of tribal people, the tribal people of India mostly live in forests hills, plateaus and naturally isolated regions and are differently termed as Adivasi (original settlers), Adim niwasi (oldest ethnological sector of population), Adimjati (primitive caste), Anusuchit Janjati (scheduled tribe) and several names signifying their ecological

or economic or historical or cultural characteristic. Among these the most popular is 'Adivasi', while in India constitution name for them is 'Anusuchit Janjati' (Scheduled tribe) (Jain, 1987).

Tribal Population

India in South East Asian subcontinent is an abode of nearly 2000 ethnic groups of people that includes some 550 tribal communities found inhabited with their language and culture in 30 different States and Union Territories (except Punjab, Haryana, Delhi NCT, Chandigarh UT and Puducherry UT). As per the census 2011, the tribal population of India is 10, 42, 81, 034 (i.e. 8.2% of country population). The states and Union territories with tribal population in the descending order can be arranged as follow: Lakshadweep Islands UT (94.8%), Mizoram (94.4%), Nagaland (86.5%), Meghalaya (86.1%), Arunachal Pradesh (68.8%), Dadra Nagar Haveli UT (52.0%), Manipur (35.1%), Sikkim (33.8%), Tripura (31.8%), Chhattisgarh (30.6%), Jharkhand (26.2%), Odisha (22.8%), Madhya Pradesh (21.1%), Gujarat (14.8%), Rajasthan (13.5%), Assam (12.4%), Jammu & Kashmir (11.9%), Goa (10.2%), Maharashtra (9.4%), Andaman & Nicobar Islands UT (7.5%), Andhra Pradesh (7%), Karnataka (7%), Daman & Diu UT (6.3%), West Bengal (5.8%), Himachal Pradesh (5.7%), Uttarakhand (2.9%), Kerala (1.5%), Bihar (1.3%), Tamil Nadu (1.1%) and Uttar Pradesh (0.6). Table-2.

The study of tribal communities (Ethnobotany)

The term 'Ethnobotany' was first coined by Dr. J.W. Harshberger on 4th Dec. 1895, at a lecture in Philadelphia, to describe his field of inquiry, which he defined as the study of "plants used by primitive and aboriginal people." In 1896, Harshberger published the term and suggested "ethnobotany" be a field which elucidates the "cultural position of the tribes who used the plants for food, shelter or clothing" (Harshberger 1896).

The term quickly began to be used and a new field was opened. Until the turn of the 20th century, ethnobotany was primarily the study of native uses of plants. Prior to this term (ethnobotany), many



Fig. 1. Gond tribe women



Fig.2. Bhil tribe women



Fig.3. Kol and Mawasi tribe collecting Mahua and Chironji



Fig.4. *Abrus precatorius* L.



Fig.5. *Alangium salvifolium* (L.f) Wang.



Fig.6 *Alectra Chitrakutensis* (Rau) Prasad Dixit



Fig. 7. *Cordia maclopii* (Griff.) Hook. f. & Thom.



Fig. 8. *Gloriosa superba* L.



Fig. 9. *Trichosanthes tricuspidata* Lour.

Table-1. Region, Percentage and Important tribes of India

S. No.	Region	Percentage	Important tribes
1	Central and Eastern India (Bihar, Odisha, M.P., A.P., Andaman & Nicobar Islands)	54.73%	Gond, Bhil, Bhatra, Bharia, Kol, Halba, Kanwar, Baiga, Munda, Oraon, Santhal, Ho, Kondh, Lodha, Bhumij, Paroja, Sahariya, Bhillala, Chenchu, Sugali, Koya, Nicobarese, Onge, Jarawa etc.
2	Western India ((Rajasthan, MH, Gujarat, Damon, Diu & Dadra Nagar Haveli)	28.15%	Bhil, Meena, Garasia, Dhodia, Dhanka, Buble, Koli Mahadev, Varli, Kathodia, Konkna, Dubia, Naikda, Padha etc.
3	North-East India (All 7 states)	12.5%	Angami, Sema, Apatani, Monpa, Bhutia, Bodo, Kuki, Mao, Mikir, Adi, Naga, Chakma, Mizo, Khasi, Garo, Bhutia, Lepcha etc.
4	Southern India (T.N, Karnataka, Kerala, Pondichery and Lakshadweep)	4.22%	Malayali, Irular, Konda Reddi, Kadu Kurumba, Naikpod, Paniyan, Kuruchiyan, Koya etc.
5	Sub Himalayan region (H.P., J & K., U.K)	0.75%	Tharu, Jaunsari, Buksa, Bhotia, Bhoksa, Gaddi, Kinnaura, Gujjar, Balti, Bodh, etc.

botanists were already including the use of plants by people within their study. However, it was Harshberger who proposed that discipline of ethnobotany might be developed with its own definition, scope, objectives and methodologies. Although Harshberger's definition still provide the root of the ethnobotany, but to describe the field in broader sense ethnobotanists have given their definitions time to time.

- 1 Jones (1941) defined it as "The study of interrelationship of primitive men and plants".
- 1 Faulks (1958) "The total relationship between men and vegetation".
- 1 Schultes (1962) "The study of relationship which exists between people of primitive society and their plant environment".
- 1 Jain (1986) "The total natural relationship between man and plants".

Ethnobotany must have been the first knowledge, which the early man acquired by sheer necessity, intuition, observation and experimentation. Vast ethnobotanical knowledge exists in India from ancient time in Vedas and Samhitas. Work of Charak, Susruta and Dhanwantari's attracted serious attention of people in India even during the early centuries.

According to *Charaka Samhita* –

औषधीनाम् रूपाभ्याम् जानते ह्यज पावने ।

अविपाश्चैव गोपाश्च ये चान्ये वनवासिनरू ।।

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Cattle grazers, shepherds and forest dwellers have the deep knowledge of medicinal plants of the forest and identify them by name, morphology and properties. The Ayurveda students should learn the name, property and morphological characters of medicinal plants from these people with deep interaction.



Table-2. State/UT Tribal Population (Census of India 2011)

S.No.	Name of State/UT	Total population	Tribal population	% of Tribal Population	State Rank
1	Andaman & Nicobar Islands (UT)	379944	28530	7.5	20
2	Andhra Pradesh	84580777	5918073	7.0	21
3	Arunachal Pradesh	1383727	951821	68.8	5
4	Assam	31205576	3884371	12.4	16
5	Bihar	103804637	1336573	1.3	28
6	Chandigarh (UT)	1054686	0	0.0	0
7	Chhattisgarh	25545198	7822902	30.6	10
8	Dadra & Nagar Haveli (UT)	343709	178564	52.0	6
9	Daman, Diu (UT)	242911	15363	6.3	23
10	Delhi (NCT)	16753235	0	0.0	0
11	Goa	1457723	149275	10.2	18
12	Gujarat	60439692	8917174	14.8	14
13	Haryana	25353081	0	0.0	0
14	Himachal Pradesh	6864602	392126	5.7	25
15	Jammu & Kashmir	12541302	1493299	11.9	17
16	Jharkhand	32988134	8645042	26.2	11
17	Karnataka	61130704	4248987	7.0	22
18	Kerala	33387677	484839	1.5	27
19	Lakshadweep (UT)	64473	61120	94.8	1
20	Madhya Pradesh	72626809	15316784	21.1	13
21	Maharashtra	112374333	10510213	9.4	19
22	Manipur	2570390	902740	35.1	7
23	Meghalaya	2966889	2555861	86.1	4
24	Mizoram	1097206	1036115	94.4	2
25	Nagaland	1978502	1710973	86.5	3
26	Odisha	41974218	9590756	22.8	12
27	Puducherry (UT)	1244464	0	0.0	0
28	Punjab	27704236	0	0.0	0
29	Rajasthan	68548437	9238534	13.5	15
30	Sikkim	610577	206360	33.8	8
31	Tamil Nadu	72138958	794697	1.1	29
32	Tripura	3673917	1166813	31.8	9
33	Uttar Pradesh	199581477	1134273	0.6	30
34	Uttarakhand	10116752	291903	2.9	26
35	West Bengal	91347736	5296953	5.8	24

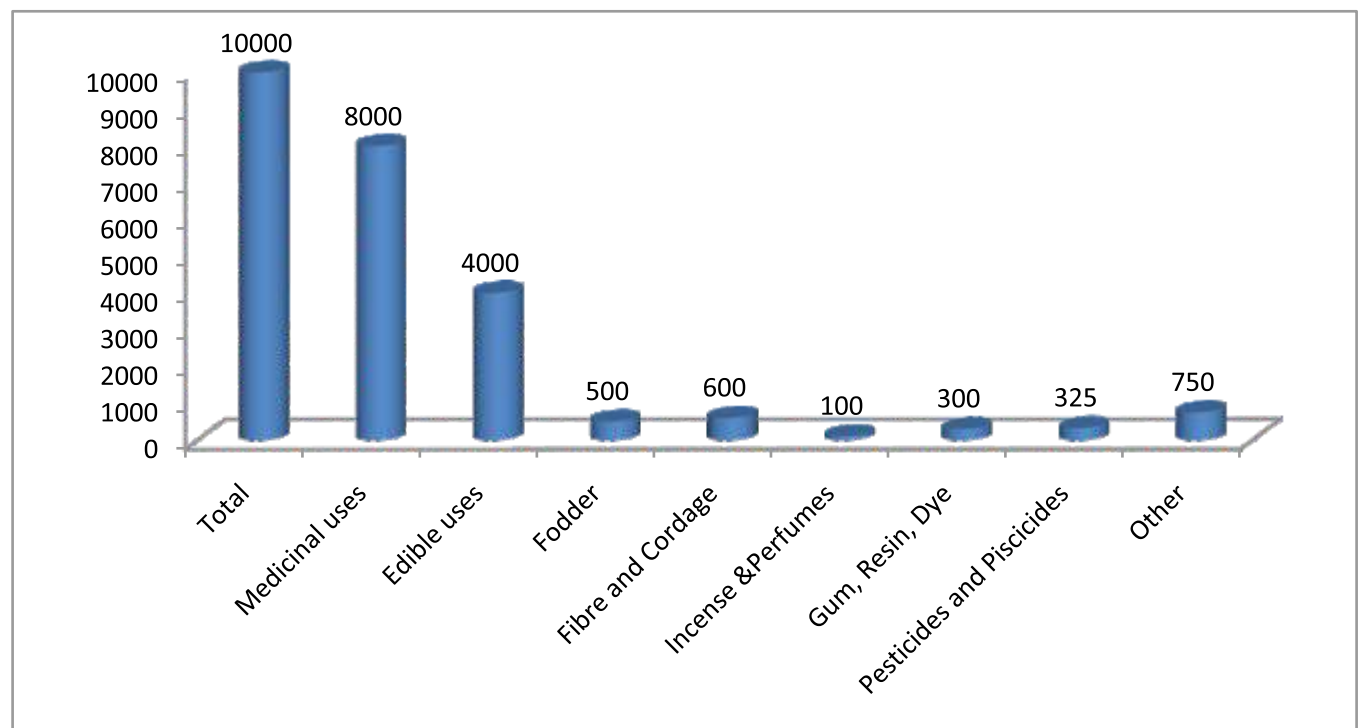
India is rich in tribal communities since ancient times, so study on Ethnobotany in India was initiated by Dr. S.K. Jain from tribals of Central India in 6th decade of 20th century which has resulted in the publication of above 1500 research papers, about 100 books and hundreds of Ph. D. thesis to develop a base for data bank on the subject (Sahoo, 2013).

The forests have been the home for many of these tribes and they have deep rooted association with the forests and nature around. Their relationship with the forest has always been harmonious and their whole life revolves around the forest resources. Tribals depend on forests for their livelihood and food security. The tribals also depend on forest flora for meeting their food, medicine and other material requirements. They collect many non timber forest products like gum, resin, dyes, honey, cane, reed, bidi leaves, fruits, fuel wood, fodder and material required for agriculture, household and thatching etc. They have acquired unique knowledge about the uses of many wild flora and fauna through generations most of which are either lesser known or hitherto unknown to the outside world. This treasure of traditional

knowledge if subjected to scientific scrutiny could benefit them, the country and the human kind in many ways. The inroads of modernization are presently posing a threat to this traditional knowledge and these are in the imminent danger of losing out, this age old wisdom and expertise can be lost for all times to come. It was in this background that the Ministry of Environment and Forests, Govt. of India launched the "All India Coordinated Research Project on Ethnobiology" (AICRPE) from 1982-1998. During the ethnobotanical survey which was carried out by 20 different research centers, universities and colleges among the tribal communities of different states of India between 1982 to 1998. Over 10,000 plant species as used by tribals for meeting their varied requirements have been recorded. The plants used for different purposes are given below:

Plants used by the tribals for various purposes

1. **Plants used as medicine:** The medicinal plants used by the tribal communities for the treatment of their own ailments and diseases



and their domestic animals. The common plants used by them are *Abrus precatorius*, *Abutilon indicum*, *Acacia nilotica*, *Achyranthus aspera*, *Aegle marmelos*, *Alangium salvifolium*, *Alectra chitrakutensis*, *Ampelocissus latifolia*, *Aristolochia indica*, *Asparagus racemes*, *Blumea lacera*, *Boerhavia diffusa*, *Bacopa monnieri*, *Bombax ceiba*, *Caesalpinia bonduc*, *Cassia tora*, *Celastrus paniculatus*, *Centella asiatica*, *Cocculus hirsutus*, *Convolvulus prostratus*, *Cordia macleodii*, *Desmodium gangeticum*, *Euphorbia hirta*, *Grewia hirsuta*, *Helicteres isora*, *Holarrhena pubescens*, *Justicia adhatoda*, *Morina oleifera*, *Mucuna pruriens*, *Oroxylum indicum*, *Phyllanthus amarus*, *Plumbago zeylanica*, *Pueraria tuberosa*, *Terminalia arjuna*, *T. Bellirica*, *T. chebula*, *Tinospora cordifolia*, *Vernonia cinerea*, *Woodfordia fruticosa* etc.

2. **Plants used as food:** *Aegle marmelos*, *Amaranthus paniculatus*, *Basella rubra*, *Bauhinia vahlii*, *Buchanania lanzan*, *Carissa carandas*, *Cassia tora*, *Chenopodium album*, *Chlorophytum tuberosum*, *Coccinia grandis*, *Colocasia esculenta*, *Corchorus olitorius*, *Cordia dichotoma*, *Cucumis melo*, *Curcuma angustifolia*, *Dendrocalamus strictus*, *Dillenia pentagyna*, *Dioscorea alata*, *D. hispida*, *Diospyros melanoxylon*, *Eleusine coracana*, *Emblica officinalis*, *Grewia rothii*, *Lablab purpureus*, *Madhuca longifolia*, *Mangifera indica*, *Momordica charantia*, *M. Dioica*, *Moringa oleifera*, *Mucuna pruriens*, *Murraya koenigii*, *Paspalum scrobiculatum*, *Pithecellobium dulce*, *Portulaca oleracea*, *Syzygium cuminii*, *Tamarindus indica*, *Tamilnadia uliginosa*, *Zanthoxylum armetum*, *Ziziphus nummularia*, *Z. mauritiana* etc.
3. **Plants used as fibre:** *Abutilon hirtum*, *A. polyandrum*, *Bauhinia racemosa*, *B. vahlii*, *Butea monosperma*, *B. parviflora*, *Careya arborea*, *Crotalaria juncea*, *Desmostachya bipinnata*, *Grewia rothii*, *Helicteres isora*, *Hibiscus cinnabarinus*, *H. sabdariffa*, *Ichnocarpus frutescens*, *Sesbania bispinosa*,

Sterculia urens etc.

4. **Plants used for extracting oil:** *Argemone mexicana*, *Buchanania lanzan*, *Celastrus paniculatus*, *Cymbopogon martini*, *Guizotia abyssinica*, *Jatropha curcas*, *Madhuca longifolia*, *Pongamia pinnata*, *Ricinus communis*, *Schleichea oleosa*, *Shorea robusta*, *Terminalia bellirica*, *Vetiveria zizanioides* etc.
5. **Plants used for gum and resin:** Gum and resin is collected from *Acacia nilotica* ssp *indica*, *Anogeissus latifolia*, *Boswellia serrata*, *Buchanania lanzan*, *Gerdenia resinifera*, *Lannea coromandelica*, *Pterocarpus marsupium*, *Shorea robusta*, *Sterculia urens* etc.
6. **Plants used for dye and tannin:** *Acacia catechu* (heart wood), *Acacia nilotica* ssp. *indica* (bark), *Butea monosperma* (flowers), *B. superba* (flowers), *Careya arborea* (bark) *Emblica officinalis* (leaf), *Pavetta tomentosa* (root), *Shorea robusta* (bark), *Terminalia alata* (bark), *T. arjuna* (bark), *Woodfordia fruticosa* (flowers) and *Ziziphus xylopyrus* (fruits) etc.
7. **Plants used for narcotics, drinks and intoxicants:** *Borassus flabellifer*, *Caryota urens*, *Elephantopus scaber*, *Hibiscus mutabilis*, *Madhuca longifolia*, *Neolitsea chinensis*, *Nicotiana tabacum*, *Trema orientalis* etc.
8. **Plants used as fish poison:** *Aegle marmelos* (root bark), *Barringtonia acutangula* (Stem bark), *Butea superba* (bark), *Caesalpinia bonduc* (Bark), *Careya arborea* (stem bark), *Casearia tomentosa* (fruit), *Cleistanthus collinus* (bark, leaves, fruits), *Diospyros malabarica* (fruits), *Milletia auriculata* (bark), *Strychnos potatorum* (seed), *Wrightia tinctoria* (leaves) and *Zanthoxylum armetum* etc.
9. **Plants used as food plates:** Leaves of *Butea monosperma*, *B. superba*, *Bauhinia vahlii*, *Macaranga peltata*, *Nelumbo nucifera*, *Shorea robusta* etc. are used for making pattal and dauna.

Besides, a large number of plants are used for tribal crafts, agriculture and household implements, thatching and magico-religious beliefs etc.

Drugs developed from plants

WHO estimated that almost 80% of the world population particularly those located in developing and under developed countries continue to depend on traditional medicine which is predominantly based on plant remedies. The importance of plant based medicine which was waned during the past 100 years has once again getting fully waxed and emerging with its full splendour and popularity. This resurgence in plant medicine is mainly due to the increasing evidence/realization of the health hazards associated with the indiscriminate use of modern synthetic medicines. According to WHO, the resurgence of greater public interest in plant based medicine is rapidly increasing because of green wave sweeping over the world. It is now opening an unprecedentedly as a new powerful market sector for plant based drugs. The scope of ethnobotany in drug research needs no elaboration. Folk medicine followed by critical scientific evaluation has produced new drugs to fight diseases. Some folk medicines are now in main stream and used for medicare programme. Of the 120 active compounds currently isolated from higher plants and used in medicine, 74 percent show a positive correlation between their modern therapeutic use and the traditional use of the plant from which they were derived (Maheshwari, 1996). Some of them plant derived modern medicine given in the table 3.

Minor Forest produces as source of livelihoods of tribal's

The economy of the tribal people mainly depend upon the collection of minor forest produces which they collect and sale in nearby local markets and earn some money for their livelihoods. The minor forest produces they collect such as fruits of Aonla (*Phyllanthus emblica*), Achar (*Buchanania lanzan*), Hard (*Terminalia chebula*), Baheda (*Terminalia bellirica*), Marorphali (*Helicteres isora*), Mahua Gulli (*Madhuca longifolia*), flowers of Mahua (*Madhuca longifolia*), Dhawai (*Woodfordia fruticosa*), Palash (*Butea monosperma*), Gum of Kullu (*Sterculia urens*), Gurja (*Lannea coromandelica*), Sal (*Shorea robusta*),

Table-3. Drugs developed from plant sources

Name of drug	Property	Name of plants
Artemisinin	Antimalarial	<i>Artemisia annua</i>
Caffeine	Stimulant	<i>Camelia sinensis</i>
Codeine	Analgesic	<i>Papaver somniferum</i>
L-Dopa	Antiparkin-sonian	<i>Mucuna pruriens</i>
Digitoxin	cardiotonic	<i>Digitalis purpurea</i>
Ephedrine	Anti-asthmatic	<i>Ephedra vulgaris</i>
Gossypol	Male contraceptive	<i>Gossypium herbasiium</i>
Quinine	Antimalarial	<i>Cinchona officinalis</i>
Reserpine	Hypotensive, Tranquilizer	<i>Rauwolfia serpentina</i>
Vicristine, vinblastine	Anti-neoplastic	<i>Catharanthus roseus</i>
Podophyllo-toxin	Condiloma	<i>Podophyllum peltetum</i>
Digitoxin	Arterial fibrillation	<i>Digitalis purpurea</i>
Ephedrin	Brochodilator	<i>Ephedra sinica</i>
Eugenol	Toothache	<i>Syzygium aromaticum</i>
Psoralin	Vitiligo	<i>Psoralea corylifolia</i>
Sennoside A,B	Laxative	<i>Cassia angustifolia</i>
Papain	Attenuator of mucus	<i>Carica papaya</i>
Picrolive	Chronic hepatitis	<i>Picrorrhiza curroa</i>
Guggulipid	Hyper-lipidaemic	<i>Commiphora wightii</i>
Taxol	Ovarian breast cancer	<i>Taxus baccata</i>
Jivaniya	Antifatigue	<i>Trichopus zeylanicus</i>

Babool (*Acacia nilitica* ssp *indica*), Salai (*Boswellia serrata*), Gabdi (*Cochlospermum religiosum*), Dhawa (*Anogeissus latifolia*), Khair (*Acacia catechu*), Leaves of Tendu (*Diospyros melano-*



xylon), Palash (*Butea monosperma*), Purain (*Nelumbo nucifera*), Mahul (*Bauhinia vahlii*), Khajur (*Phoenix sylvestris*), Roots of Satawar (*Asparagus racemosus*), Safed musali (*Chlorophytum tuberosum*), Kali musali (*Curculigo orchioides*), Khas (*Vetiveria zizanioides*), inflorescence of Phoolbahari (*Thysanolaena maxima*), Barks of Arjun (*Terminalia arjuna*), Dalchini (*Cinnamomum verum*), Honey, Lac, Kosa etc.

The following small scale cottage industries/units can be established in forest rich tribal areas for up liftment of their socio-economic status (Jain, 2013) such as:

- | Food processing units
- | Value addition units should be established in tribal areas such as fruits of Aonla (*Phyllanthus emblica*), Harra (*Terminalia chebula*), Baheda (*Terminalia bellirica*) processing etc.
- | Food plats making units based on leaves of *Butea monosperma*, *Bauhinia vahlii*, *Shorea robusta* etc.
- | Mats, baskets, brooms making units based on Leaves of *Phoenix sylvestris*, *Dendrocalamus strictus*, *Vetiveria zizanioides*, *Desmostachya bipinnata* etc.
- | Toy making units based woods of *Wrightia tinctoria*, culms of *Dendrocalamus strictus* etc.
- | Gum, lac, and kosa collection centres should be established in tribal areas
- | Medicinal plants collection centres should be established in tribal areas
- | Bidi making units (Leaves of *Diospyros melanoxylon*)
- | Oil extracting units based on oil yielding plants
- | Kattha making units (Heart wood of *Acacia catechu*)

- | Liquor distillation units (Flowers of *Madhuca longifolia*)
- | Cane furniture making units

Some recommendations for boost up of tribal's livelihoods

1. Landless tribals should be rehabilitated through a programme of settlements. Waste lands including the degraded forest lands should be allotted to such tribal families for raising social forestry plantations.
2. Multipurpose species of plants to meet the food, fodder, fuel wood, medicine and other traditional requirements of the local tribal's should be included in the social forestry operations in tribal areas.
3. Nursery raising activities by individual tribal families should be promoted as a source of income generation. The existing government extension facilities and that of the voluntary agencies should be utilized in promoting such activities.
4. Considering the great relevance of the minor forest produces in the economic development of forest dwellers, it is suggested that the tribal's may be trained to tap these forest resources in the scientific way to avoid their destruction. Value addition to such products shall be beneficial to the tribal's.
5. Contractor agencies at all levels of forestry operations especially in extracting minor forest produces should be eliminated so that it generates gainful employment to the local tribal's. Co-operative societies under the direct supervision of Tribal Welfare Departments or such organizations should monitor these activities.
6. When a drug is developed based on tribal knowledge suitable benefit sharing should be given to the particular tribal for their own use while transferring the production technology to any agency.

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