

Campus-Wide Floristic Diversity of Medicinal Plants in Indian Institute of Technology-Madras (IIT-M), Chennai

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Abstract

The floristic diversity of plants and their abundance were analyzed in 2.5 km campus to explore their medical importance by random sampling. The results for plant diversity in IIT-M campus showed nearly 100 species of flowering plants, with genera belonging to nearly 40 families. The most dominant family in the present study is Fabaceae with 15 species (25%) of the medicinal trees. In addition, the dominant medicinal herbs belong to the families of Acanthaceae, Apocynaceae, Fabaceae and Rubiaceae containing 4 species (12%) each. The identified medicinal tree and herb are verified with Red data book to explore their conservation status of every identified medicinal trees and herbs. On comparison with the existing IUCN red data list, the conservation status of 73% of trees and herbs identified in the present study were not assessed. Also, the biodiversity of plants focused on ethano-botanical aspects to reveal their medicinal uses.

Keywords

Medicinal Plants, Medicinal Tree, Plant Diversity, Ethano Botany

1. Introduction

Biodiversity plays a key role in the livelihoods of tribes and other people to meet their needs in day-to-day life. The plant kingdom is directly connected with human beings from the beginning of its origination in the universe [1]. India is one of the vast biodiversity-rich countries in the world where the medicinal plants

have had traditional importance for ages, specifically, in the fields of Ayurveda, Siddha, Unani, and homeopathy. Nearly 75% of the remedially important plant species grows in almost wild conditions [2]. In the Southern part of India, Indian Institute of Technology-Madras (IIT-M) geographically located with Latitude:: 13.04N, Longitude:: 80.17E, Altitude:: 6 - 16 m above mean sea level. The campus spans over an area of 236 ha comprising of three major zones—academic, residential and hostel; each acting as a thriving environment for flora and fauna and a wide variety animals and reptiles. A fourth zone identified as Wilderness Zone has been selected for biodiversity assessment. This zone has the richest biodiversity in the Campus. Each zone approximately holds 60 ha area in an uneven configuration or shape. This wilderness zone vegetation is majorly of Southern Thorn Forest type, dominated by *cactus* followed by *Ficus* which has significant cultural value. As per the survey, the campus has 432 species of plants were identified/observed (Figure 1).

2. Materials and Methods

The institute campus area has a wide distribution of medicinal plants which was made as the main objective of the present study. The distribution of these medicinal plants/tree were identified the aid of taxonomists from Dept of Botany, Alagappa university by referring to authentic literature of the regional flora web database developed by the Prakati Wildlife club of IIT-Madras, Chennai and cross verified with “The flowering plants of Madras city and its immediate neighborhood” [3]. An effective analysis has been performed to identify the available medicinal plants along with their distribution and their medicinal uses.

2.1. Ethno Botanical Survey

The ethno botanical survey was carried out by wild life club volunteers of IIT-Madras, between august and September 2016. This study covered total vegetation of the area with emphasis on the ethno botanical hotspots of IIT-Madras campus.

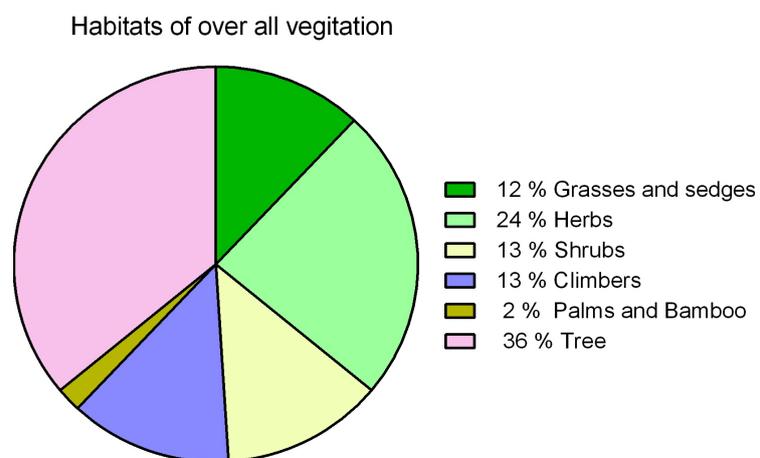


Figure 1. Percentage habitat wise distribution of overall vegetation.

2.2. Overall Diversity of Vegetation

Thirty-six per cent of the non-cultivated plants species are trees. Excluding cultivated trees such as papaya, lime, sapota, etc., that are rarely found outside gardens and homesteads, 107 species of trees are present on the IIT-M campus. The greater presence of tree species has rendered the vegetation type as a forest.

2.3. Over All Diversity of Medicinal Trees/Herbs

298 species of non-cultivated plants were identified on the campus. The numbers may increase between 350 - 400 species while including the garden plants. 36% of the non-cultivated plants on the campus are trees. However, of the trees only 40% are native. The higher contribution to the diversity of native flora was rose from the grasses (100%), climbers (84%) and herbs (80%). 107 sps., of plants, are non-native. Among these 9 species were invasive. *Prosopis juliflora* is the most invasive plant on the campus. 50% to 60% of the trees in the wilderness zone were dominated by this species. Both tree and herb specimens were collected and identified using regional flora. The collected plant specimen's family and species were confirmed with community herbarium, MS Swaminathan Research Foundation, Chennai.

2.4. Calculation of Shannon Index of Species Diversity and Species Richness

The species diversity of medicinal trees and herbs were calculated using Shannon diversity index [4]. It has a combination of two quantifiable measures like species richness and species accountability. Higher in numbers of a species denotes wide range of diversity, Shannon-Wiener diversity Index is defined and given by the following function: MATLAB program was created to calculate the Shannon index. [5].

$$H = \sum[(p_i) \times \ln(p_i)]$$

P_i = proportion of total samples represented by species i

S = number of species, = species richness,

H_{max} = Ln(S) = Maximum diversity possible

E = Evenness = H/H_{max}

3. Determination of Conservation Status of Plants and Herbs

The universal conservation status of identified trees and Herbs were determined by IUCN red data list cross verification.

4. Result

The results on the survey of the plant diversity in the IIT-M campus showed nearly 100 species of flowering plants (both trees and herbs). Among these, 100 genera belonged to 40 families. The most dominant family in the present study was Fabaceae with 18 species (25%). Next to that, *Moraceae* comprises 7 species (9%), *Malvaceae* include 6 species (8%). The dominant medicinal herbs are from

Acanthaceae, Apocynaceae, Fabaceae and Rubiaceae contain 4 species (12%), and *Convolvulaceae*, *Euphorbiaceae*, *Phyllanthaceae*, and *Vitaceae* are second dominant with 2 species (4%) each. The overall habitat is dominated by Trees in the campus (36 %). The detailed investigation of family in the present study and their medicinal values in a different area is represented in **Figure 2** and **Table 1** & **Table 2**.

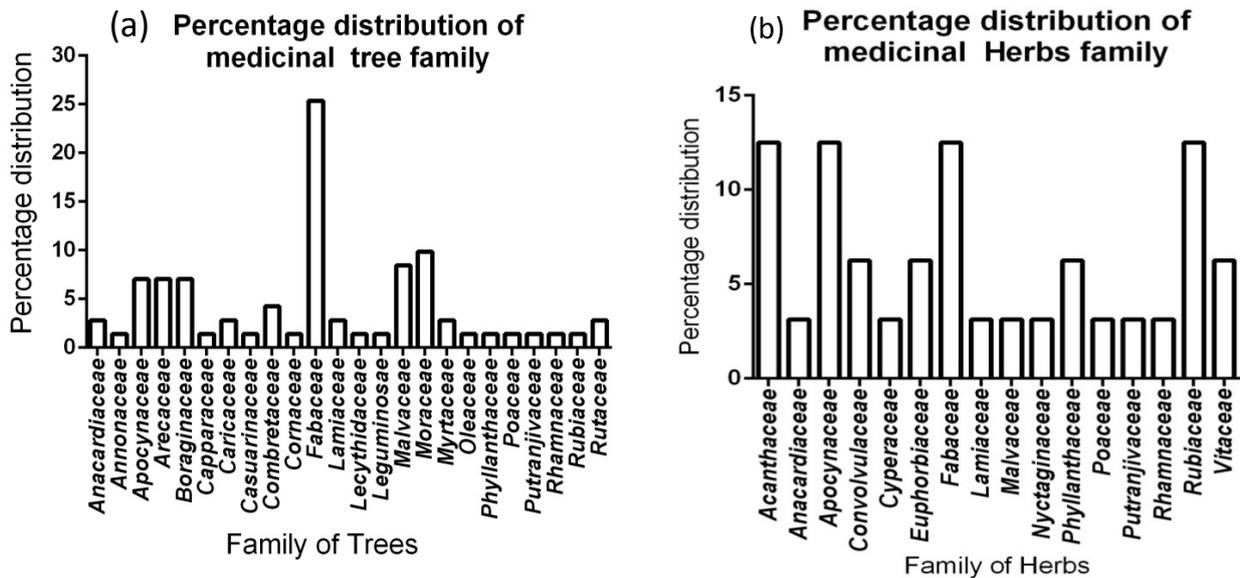


Figure 2. Percentage distribution of (a) medicinal trees and (b) herbs.

Table 1. Diversity of trees on campus.

Order	Family	Botanical name	Red data list	Portin of plant	Use	Ref
Fabales	Fabaceae	<i>Acacia auriculiformis</i>	LC	Bark	Sores and skin complaints	[6]
Fabales	Fabaceae	<i>Acacia leucophloea</i>	LC	Bark	Traditional medicine to treat bronchitis	[7]
Ericales	Sapotaceae	<i>Achras zapota</i>	NA	Premature fruits and flowers	Treatment of diahheria and pulmonary complaints	[8]
Fabales	Fabaceae	<i>Adenanthera pavonina</i>	NA	Wood, seed, leaves and bark	Treatment of rheumatism, Hair wash	[9]
Cornales	Cornaceae	<i>Alangium salvifolium</i>	NA	Leaves, Fruits, Tree bark, Root bark	Anti-diabetic, blood pressure lowering effect, astringent, rheumatism, Leprosy and inflammatory patches.	[10]
Fabales	Fabaceae	<i>Albizia lebbek</i>	NA	Leaves, seeds, bark, and roots	Gastro intestine complaints Astringent, anthelmintic and snake bites	[11]
Gentianales	Apocynaceae	<i>Alstonia scholaris</i>	LC	Leaves, bark, and Fruit	Rheumatic swellings, malarial fevers and anthelmintic	[12]
Rosales	Moraceae	<i>Artocarpus heterophylla</i>	NA	Leaves, fruit and seed	Skin diseases, astringent, and carminative,	[13]

Continued

Sapindales	Rutaceae	<i>Atlanta racemosa</i>	NA	Stem and leaves	Insect anti feedants	[14]
Sapindales	Meliaceae	<i>Azadirachta indica</i>	NA	Leaves, stem bark, fruits and seed	Anthelmintic, detoxify the blood, treatment for fever etc.,	[15]
Poales	Poaceae	<i>Bambus vulgaris</i>	NA	Leaves and shoots	Treatment for febrile disease	[16]
Fabales	Fabaceae	<i>Bauhinia racemosa</i>	NA	Flower, fruit, root, leaf. Bark and bud	Oral disorders-cure Toothache-Hunchback-Burning sensation-Multi nodular Tuberculosis	[17]
Fabales	Leguminosae	<i>Bohania purpurea</i>	NA	Flower, root, leaf, bark and bud	Oral disorders, cure Toothache-Hunchback, Burning sensation, Multi nodular Tuberculosis	[18]
Malvales	Malvaceae	<i>Bombax ceiba</i>	NA	Leaves, root and flower	Seminal disorders. Nocturnal emission, semen problems, Leucorrhoea, Improve breast milk	[19]
Arecales	Arecaceae	<i>Borassus flabellifer</i>	NA	Leaves, root and flower	Antihelmintic and diuretic	[20]
Fabales	Fabaceae	<i>Butea monosperma</i>	NA	Whole plant	Anti-Semetic, Diarrhea, Dysentery, Intestinal Worms, Diabetes, Sore Throat	[21]
Fabales	Fabaceae	<i>Caesalpinia coriaria</i>	NA	Whole plant	A sore throat, stomach ache, tonic also used in tanning purpose in leather processing	[22]
Brassicales	Capparaceae	<i>Caparis zeylanica</i>	NA	Root, seed and aerial part	Antipyretic agent	[23]
Brassicales	Caricaceae	<i>Carica papaya</i>	DD	Flower, Fruits, Seed, Leaves, bark	Carminative, diuretic, chronic diarrhea, snakebite, Febrifuge, jaundice, pectoral properties, STD, anti-fungal activity, jaundice, anti-hemolytic activity, sore teeth.	[24]
Arecales	Arecaceae	<i>Caryota mitis</i>	NA	Fruit	Anti-diabetic	[25]
Fabales	Fabaceae	<i>Cassia fistula</i>	NA	Root, Leave, bark	Astringent, febrifuge and strong purgative rheumatism and facial paralysis, insect bites	[26]
Fabales	Fabaceae	<i>Cassia siamea</i>	NA	Fruit, leaves and flower	Antipyretic, to cure intestine worms	
Fagales	Casuarinaceae	<i>Casuarina equisetifolia</i>	NA	Root	Dysentery, diarrhea and stomach ache treatment	[27]
Malvales	Malvaceae	<i>Ceiba pentandra</i>	NA	Leaves	Diabetic reducing agent	[28]
Arecales	Arecaceae	<i>Cocos nucifera</i>	NA	Coconut shell fiber Root	Diarrhea, renal diseases	[29]
Myrtales	Combretaceae	<i>Combretum ovalifolium</i>	NA	Leaves and root	Antipyretic	[30]
unplaced	Boraginaceae	<i>Cordia oblica</i>	NA	Leaves, root, flower	Anti diuretic and antipyretic	[31]
Ericales	Lecythidaceae	<i>Couropita guianensis</i>	NA	Fruit pulp, bark and flowers	To heal the infected skin on animals, odontalgia	[32]

Continued

Fabales	Fabaceae	<i>Delonix regia</i>	LC	Leaves	Antiruhmatism and ant diabetic agent	[33]
Fabales	Fabaceae	<i>Dichrostachys cinerea</i>	LC	Leaf and bark	Vomiting agent	[34]
Malpighiales	Phyllanthaceae	<i>Emblica Officinalis</i>	NA	Leaf, bark	Immune modulatory, anti-inflammatory, antiulcer, hepatoprotective, and anticancer actions. Ant diabetic Ant diarrheal Effect Analgesic and Antipyretic	[35]
Fables	Fabaceae	<i>Enterolobium contortisiliquum</i>	NA	Root and seed coat	Anti helmintic	[36]
Fables	Fabaceae	<i>Erythrina variegata</i>	LC	Bark, leaves	Antipyretic, asthma and coughs	[37]
Rosales	Moraceae	<i>Ficus amplissima</i>	NA	Bark, leaves	Anti-diabetic, anticancer	[37]
Rosales	Moraceae	<i>Ficus benghalensis</i>	NA	Bark, leaves	Anti-diabetic, Antipyretic, asthma and coughs	[38]
Rosales	Moraceae	<i>Ficus elastica</i>	NA	Bark, leaves	Anti-inflammatory, anti diabetic, anticancer	[39]
Rosales	Moraceae	<i>Ficus racemosa</i>	NA	Leaves, bark, latex	Anti-diabetes, astringent, astringent.	[40]
Rosales	Moraceae	<i>Ficus religiosa</i>	NA	Leaves, bark, latex	Anti helmintic activity, immune modulator activity, Anticonvulsant activity	[41]
Lamiales	Lamiaceae	<i>Gmelina asiatica</i>	NA	Root, stem bark, flower and leaf	A headache, snake bite, ulcer	[42]
Malvales	Malvaceae	<i>Guazuma tomentosa</i>	NA	Fruit, Leaf Root, seed	A cough, Hemorrhage, Infections, Leprosy, Nephritis, Asthma, Child Birth	[43]
Ericales	Sapotaceae	<i>Hibiscus tiliaceus</i>	NA	Flowers, root and bark	Enema and Anti depressant	[44]
Gentianales	Rubiaceae	<i>Ixora pavetta</i>	NA	Leaves, flower	Anticancer activity	[45]
Lamiales	Bignoniaceae	<i>Kigelia pinnata</i>	NA	Leaves, fruits and bark	Anti diabetic, Anti inflammatory, anticancer	[46]
Sapindales	Rutaceae	<i>Limonia acidissima</i>	NA	Fruits, leaves and root	Astringent, diuretic, cardio tonic and tonic for the liver and lungs. The antidote for snake bites.	[47]
Ericales	Sapotaceae	<i>Madhuca longifolia</i>	NA	Flower, fruit and seed	Analgesic and diuretic. Astringent and used in chronic tonsillitis and pharyngitis, rheumatism and skin infection, oil used in skin disease.	[48]
Sapindales	Anacardiaceae	<i>Mangifera indica</i>	DD	Leaf, fruit, stem bark and flower	Anti-diabetic, antiviral activity Antitumor and HIV, anti diarrheal	[49]
Fabales	Fabaceae	<i>Millettia peguensis</i>	DD	Leaf, fruit, stem bark and flower	To treat respiratory difficulties, Edema, cold and headaches	[50]
Lamiales	Bignoniaceae	<i>Millingtonia hortensis</i>	NA	Leaf and flower	Anticancer	[51]

Continued

Ericales	Sapotaceae	<i>Mimusopis elengi</i>	NA	Leaf, root, fruit, seed, bark and flower	Antinociceptive, diuretic effects, gastro protective, antibacterial, antifungal, anti cariogenic, free radical anti hyperglycemic	[52]
Lamiales	Oleaceae	<i>Nyctanthes arbor-tristis</i>	NA	Flowers	Anti proliferative and anti diabetic	[53]
Fabales	Fabaceae	<i>Parkia biglandulosa</i>	NA	Bark, leaves and seeds	Dental plaque and caries, pneumonia stomach ache, severe cough, diarrhea, wounds, dermatitis, amebiasis, leprosies, alkalosis, tracheitis, conjunctivitis and others like hemorrhoids.	[54]
Fabales	Fabaceae	<i>Peltophorum pterocarpum</i>	NA	Flower, bark and leaves	Paste of stem bark prepared with water is applied topically to treat wounds	[55]
Arecales	Arecaceae	<i>Phoenix sylvestris</i>	NA	Leaf, fruit, seed and bark	Insomnia Treatment. Dysentery and eye lotion	[56]
Gentianales	Apocynaceae	<i>Plumeria obtusa</i>	NA	Flower and bark	Antitumor, antiviral, analgesic, antispasmodic and hypoglycemic	[57]
Gentianales	Apocynaceae	<i>Plumeria rubra</i>	NA	Leaf and Pod	Abortifacient activity and bio control agent	[58]
Magnoliales	Annonaceae	<i>Polyalthia longifolia</i>	NA	Bark	Febrifuge, anti helminthic, skin disease, diabetes, hypertension, helminthiasis, and vitiated conditions of vata and pitta	[59]
Fabales	Fabaceae	<i>Pongamia pinnata</i>	LC	Leaf, bark, seed and flower	Anti-protozoal, Anti-inflammatory activity, anticonvulsant activity, Anti-diabetic activity,	[60]
Myrtales	Myrtaceae	<i>Psidium guajava</i>	NA	Fruits Fruit skins Leaves	Effect on dental plaque, Antimalarial effects, Antitussive effects, Hepato protective effect	[61]
Myrtales	Myrtaceae	<i>Eucalyptus globulus</i>	NA	Leaves and bark	Head ache anti bacterial activity	[62]
Malvales	Malvaceae	<i>Pterospermum acerifolium</i>	NA	Flowers	Ant diabetic activity	[63]
Malpighiales	Putranjivaceae	<i>Putranjiva roxburghii</i>	NA	Seed and fruit	Cough cold and sprue.	[64]
Arecales	Arecaceae	<i>Roystonea regia</i>	NA	Not yet studied	None	[65]
Fabales	Fabaceae	<i>Samanea saman</i>	NA	Leaves, Bark and root	Treatment for diarrhea, stomachache, inhibiting effect on Mycobacterium tuberculosis	[66]
Santalales	Santalum	<i>Santalum album</i>	VU		Antiulcer, diuretic, analgesic, antiseptic, expectorant and stimulant effects	[67]
Sapindales	Sapindaceae	<i>Sapindus trifoliatus</i>	NA	Leaves and fruit	Anti dandruff, anti-implantation activity, eczema, psoriasis, and removing freckles	[68]
Fabales	Fabaceae	<i>Saraka asoca</i>	NA	Leaves and bark	Antimennorhagic, uterine tonic, Anti-inflammatory, anti arthritic, cardio protective effect, Anti-nephrolithiatic	[69]

Continued

Lamiales	Bignoniaceae	<i>Spathodea campanulata</i>	NA	Leaves and bark	Ant malarial, anti-HIV	[70]
Malvales	Malveaceae	<i>Sterculia urens</i>	NA	Bark	Aboriginal, bulk laxative, throat infections	[71]
Rosales	Moraceae	<i>Streblus asper</i>	NA	Root, stem, bark, Leaves, seeds	As an application to unhealthy ulcers and sinuses and as antidote to snake bite, in epilepsy and obesity	[72]
Myrtales	Myrtaceae	<i>Syzygium cumini</i>	NA	Bark, leaves, fruits	Anti-diabetic, dysentery and bleeding gums	[73]
Lamiales	Bignoniaceae	<i>Tabebuia aurea</i>	NA	Leaves, bark and flower	Anticancer, Anti-inflammatory, Anti malaria	[74]
Fabales	Fabaceae	<i>Tamarindus indica</i>	NA	Leaves, bark and flower	Laxative, Abdominal pain, diarrhea and dysentery, Peptic ulcer Antimicrobial, ant parasitic, antifungal, antiviral, anti-nematode	[75]
Lamiales	Lamiaceae	<i>Tectona grandis</i>	NA	Leaves, bark and flower	Wound healing activity and dysentery.	[76]
Myrtales	Combretaceae	<i>Terminalia arjuna</i>	NA	Bark	Antioxidant and cardio protective activity	[77]
Myrtales	Combretaceae	<i>Terminalia catappa</i>	NA	Bark	Wound healing, anti diabetic, anti oxidant anticancer and anti-mutation	[78]
Malvales	Malvaceae	<i>Thespesia populnea</i>	NA	Leaves and bark	Anti diarrhea, wounds and cholera.	[79]
Gentianales	Apocynaceae	<i>Wrightia tinctoria</i>	LC	Leaves and bark	Wound healing activity, Anti-dandruff activity, Anti-Psoriasis activity	[80]
Rosales	Rhamnaceae	<i>Ziziphus jujuba</i>	LC	Fruits	Anorexia, fatigue and dysentery	[81]
Sapindales	Anacardiaceae	<i>Lannea coromandelica</i>	NA	Whole plant	Protozoan infection, AIDS, viral infection	[82]

Table 2. Diversity of medicinal plants on campus.

Order	Family	Botanical name	Red data list	Portion of plant	Use	Ref
Fabales	Fabaceae	<i>Alysicarpus ovalifolius</i>	NA	Whole plant	Blood purifier and diuretic	[83]
Malpighiales	Phyllanthaceae	<i>Phyllanthus maderaspatensis</i>	NA	Whole plant	Ant diabetic, spasmodic, wound, fever, inflammation, antibacterial and snake bite	[84]
Malpighiales	Violaceae	<i>Hybanthus enneaspermus</i>	NA	Leaves and fruits	Diuretic, demulcent and tonic	[85]
Fabales	Fabaceae	<i>Indigofera linnaei</i>	NA	Whole plant	Analgesic with anti-inflammatory activity,	[86]
Poales	Cyperaceae	<i>Cyperus rotundus</i>	LC	Whole plant	Spasms, stomach and bowel disorders and menstrual irregularities	[87]

Continued

Lamiales	Acanthaceae	<i>Dipteracanthus prostratus</i>	NA	Whole plant	Anti-diabetic	[88]
Malvales	Malvaceae	<i>Corchorus aestuans</i>	NA	Whole plant	ascites, pain, piles, tumors cystitis, dysuria, fever, and gonorrhoea	[89]
Caryophyllales	Nyctaginaceae	<i>Boerhavia difusa</i>	NA	Whole plant	Anti inflammatory	[90]
Lamiales	Acanthaceae	<i>Thunbergia erecta</i>	NA	Whole plant	Antitumor activity, Cytotoxicity, Hepato protective activity, Antinociceptive activity	[91]
Lamiales	Acanthaceae	<i>Tylophora indica</i>	NA	Whole plant	Bronchial asthma, cancer, dysentery, hay fever, inflammation, rheumatism, arthritis and dermatitis.	[92]
Solanales	Convolvulaceae	<i>Merreria tridentata</i>	NA	Whole plant	Anti-inflammatory and anti arthritis	[93]
Gentianales	Apocynaceae	<i>Ichnocarpus frutescens</i>	NA	Whole plant	Ant diabetic	[94]
Solanales	Convolvulaceae	<i>Evolvulus nummularius</i>	NA	Whole plant	Peptide ulcer	[95]
Gentianales	Rubiaceae	<i>Oldenlata umbellata</i>	NA	Whole plant	Stomach worm	[96]
Rosales	Rhamnaceae	<i>Zyziphus oenoplia</i>	NA	Seeds, leaf	Immuno modulatory effects	[97]
Malpighiales	Putranjivaceae	<i>Putranjiva roxburghii</i>	NA	Leaves and fruit	Colds, fevers and rheumatism	[98]
Malpighiales	Phyllanthaceae	<i>Phyllanthus reticulatus</i>	NA	Whole plant	Anti diarrheal, diuretic, cooling medicine, malaria, asthma and bark are used as astringent and diuretic.	[99]
Gentianales	Rubiaceae	<i>Canthium dicoccum</i>	VU	Whole plant	Anti-diabetic	[100]
Gentianales	Rubiaceae	<i>Benkara malabarica</i>	NA	Bark, leaves	Anticonvulsant activity	[101]
Vitales	Vitaceae	<i>Cissus vitiginea</i>	NA	Leaves, bark and root	Anti-cholesterol, anti-diabetic	
Unplaced	Boraginaceae	<i>Heliotropium indicum</i>	NA	Leaves, bark and root	Diarrhea, diabetes, venereal disease	[102]
Lamiales	Lamiaceae	<i>Hyptis suaveolens</i>	NA	Leaves, bark and root	Inflammation, gastric ulcer	[103]
Fabales	Fabaceae	<i>Desmodium triflorum</i>	LC	Leaves, bark and root	Sedative and anti-tumor	[104]
Malpighiales	Euphorbiaceae	<i>Croton bonplandianum</i>	NA	Leaves, bark and root	Antimicrobial, Anti-inflammatory Anticancer, Diuretic	[105]
Gentianales	Apocynaceae	<i>Carissa</i> sp.	NA	Fruits and leafy	Headache, rheumatism, rabies and diuretic	[106]
Gentianales	Apocynaceae	<i>Vinca rosea</i>	NA	Leaf and flower	Antihyperglycemic and hypertensive activity	[107]

NA: Not yet Assessed; LC: Least Concern; NT: Near Threatened; VE: Vulnerable ; LR: Lower Risk; EN: Endangered; DD: Data Deficient.

Shannon-Wiener diversity index of species richness (H) for the medicinal tree is 4.263 and evenness (E) is 0.972, whereas in medicinal herb species richness (H) was calculated as 3.284 and evenness (E) was 0.975 (Figure 3).

In addition to the floristic study, the present study enumerated the medicinally important plants in the study area which are used to cure different diseases. Totally 107 medicinal tree and herbs were identified in the wide campus. Of which 73% of trees and herbs are not assessed in IUCN red data list (Figure 4).

5. Conclusion

The primitive societies of India have been dependent on herbal medicines over a long period of time. In fact, all conventional systems of herbal based therapy had their roots and origin in folk medicines or asthma medicines. The knowledge of ethano botany plays a vital role in the primary health care and economy of tribal's. Increasing populations of our country require the discovery of new herbal drugs to cure both endemic and epidemic diseases without side effects. India has been endowed with rich biodiversity which comprises of nearly 12% of the global plant wealth. Due to over exploitation of forest and urbanization, one-third of the plants are endemic and endangered. In the present study, various families of

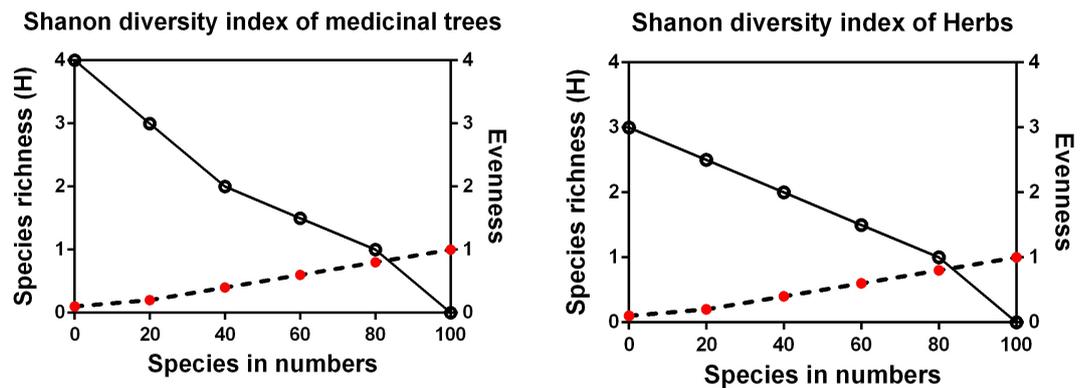


Figure 3. Shannon graph diversity of species richness index of Trees and Herbs in the study area.

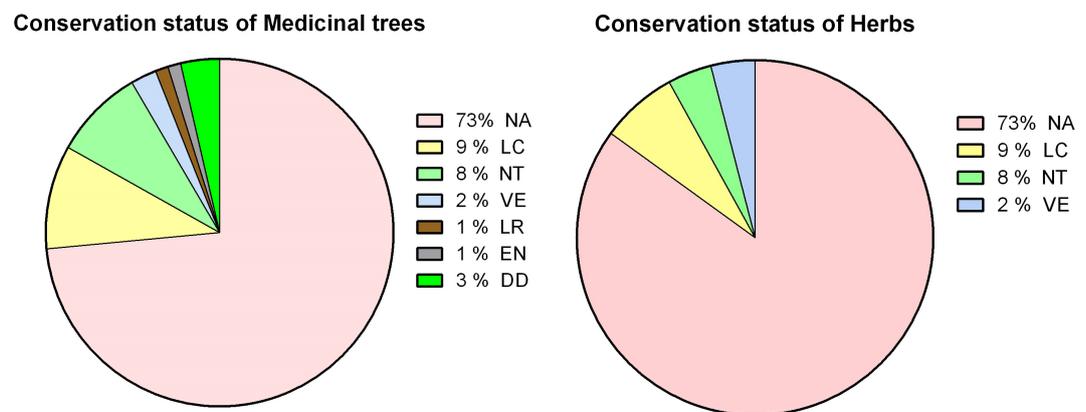


Figure 4. Conservation status of (identified in IITM campus) Tree species reported for medicinal purposes in India according to IUCN Red List. NA: Not yet Assessed; LC: Least Concern; NT: Near Threatened; VE: Vulnerable; LR: Lower Risk; EN: Endangered; DD: Data Deficient.

flowering plants are identified in the study area (IIT-M campus). Cross verification of identified plants with IUCN Red data book confirmed the IIT-M wide campus is the shelter for nearly threaded (NT), vulnerable (VE) and endangered (ED) species of medicinal trees and herbs.

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Conflict of Interests

The authors declare no conflict of interest.

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