Plant Biodiversity and Phytosociological studies on Medicinal Plants of District Jhansi Bundelkhand region, Uttar Pradesh

Kiran[1], Giri[2], Bhupendra*[3]

[1]Women Post Doctoral Fellow, [2]Associate Professor, [3]Assistant professor
[1,2]Institute of Environment & Development Studies, Bundelkhand University, Jhansi
[3]Department of Biotechnology, ITS Institute of Health & Allied sciences, Ghaziabad

Abstract: The main purpose of present investigation of medicinal plants of study area with special references to their Phytosociological studies was to collect such as data to describe the population dynamics of each medicinal plant species and how they relate to the other species in the same community. Plants growing along have mutual relationship among themselves and with the atmosphere. Interaction among different plants and between plants and their environment is the outcome of different vegetation types in different areas. Loss of biodiversity leads to ecological imbalance. So study of the plant diversity is a crucial parameter to know and assess the population structure. The present paper deal with Quantitative analysis and Importance Value Index of medicinal plant species, district Jhansi, Uttar Pradesh. Highest important index value was reported for the species *Calotropis procera* (21.05), *Tridax procumbens* (15.90), *Ocimum basilicum* (14.89) *Achyranthes aspera* (14.60) etc.

Keywords: Plant Biodiversity, Phytosociology, Medicinal Plants, Jhansi

1. Introduction

Biodiversity may be defined as the number of different native species and individuals in an ecological habitat or geographical area, with the variety of different habitats within an area & the variety of interactions that occur between different species in a habitat which results in a range of genetic variation among individuals within a species [1]. Biodiversity provides indirect benefits to human; forming the foundation for sustainable development, ecosystem services and benefits provided by the biodiversity include environmental health of our planet, providing clean air, drinkable water, Pollination, maintenance of slopes, protection of watersheds and soil formation with fertility. Ecosystem services are necessary for the humanity, supporting life, supplying so many materials, energy and most importantly absorbing waste products [2].

Plant social science or Phytosociology is defined as the discipline which concerns itself with the study of vegetation as such, with its floristic composition, structure, development and distribution. The key component of vegetation study is phytosociological analysis, with the aid of sampling techniques. Phytosociological information serves as prerequisite for understanding the structure and function of the vegetation. Some regions of India have been quantitatively explored in terms of phytosociological investigation [3, 4, 5, 6].

Geographically, district Jhansi falls in the zone of sub-tropical climate. Most part of the year the climate remains dry and monsoons usually extend from July to October. The average rainfall in this region is 760 mm against an overall average of 926 mm in the state, due to which there is shortage of surface and underground water. Jhansi is located at 25.4333 N 78.5833 E. It has a median elevation of 284 metres (935 feet). Jhansi is found within the upland of central India, a locality dominated by rocky reliefs and minerals beneath the soil. The average annual rainfall and number of rainy days in was found 1001 mm and 70 respectively. A Julian day is considered as rainy day when rainfall of that day is greater equal to 1 mm. Average annual rainfall varies from 751 mm to 1250 mm, whereas average annual rainy days varies from 56 to 83 [7].

2. Materials and Methods

The Phytosociological studies were carried out randomly during rainy season when majority of the plants were at the peak of their growth. In every study sites, 10 quadrats of 10 m X 10 m (100 sqm) size were randomly laid to study herb and shrub species of medicinal plants. The main purpose of the phytosociological analysis is to understand species characteristics, to estimate the species richness and diversity which is existing in the study area.

2.1 Quantitative analysis

The important quantitative analysis such as density, frequency, and abundance of species were determined as per Curtis and McIntosh [8].

(a) Density = $\frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied}}$

(b) Frequency (%) = $\frac{\text{Number of quadrats in which the species occured X 100}}{\text{Total number of quadrats studied}}$

(c) Abundance = $\frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occurred}}$

2.2 Importance Value Index

This index is employed to work out the importance of every species within the community structure. In scheming this index, the percentage values of the relative frequency, relative density and relative dominance are summed up together and this value is designated as the Importance Value Index or IVI of the species [9].

(a) Relative density = $\frac{\text{Number of individual of the species X 100}}{\text{Number of individual of all the species}}$

(b) Relative frequency = $\frac{\text{Number of occurrence of the species X 100}}{\text{Number of occurrence of all the species}}$

(c) Relative dominance = $\frac{\text{Total basal area of the species X 100}}{\text{Total basal area of all the species}}$

The total basal area was calculated from the add of the total diameter of immerging stems. In trees, poles and saplings, the basal area or space was measured at breast height (1.5m) and by using the formula πr^2; but however in case of herbaceous vegetation it was measured on the base level by using calipers.

3. Results and Discussion

The Phytosociological studies of medicinal plants were recorded and analyzed during rainy season from July to October 2017 in Bundelkhand region of Jhansi district total 47 medicinal plants were observed whose Phytosociology was tabulated in the table 1

Table1: Phytosociology studies of Medicinal Plant Species of study area.

S.No	Medicinal Plants	Frequency (%)	Density	Abundance	Relative density	Relative frequency	Relative dominance	IVI
1	Setaria glauca	20	0.90	4.50	1.06	1.18	2.00	4.24
2	*Catharanthus roseus*	30	0.70	2.33	0.83	1.78	2.25	4.86
3	*Hyptis suaveolens*	20	1.00	5.00	1.18	1.18	4.88	7.24
4	*Eclipta prostrate*	80	1.80	2.25	2.13	4.73	1.32	8.18
5	*Sonchus arvensis*	30	1.50	5.00	1.77	1.78	2.82	6.36
6	*Lantana camara*	70	1.30	1.86	1.53	4.14	1.76	7.43
7	*Desmodium trifolium*	60	1.00	1.67	1.18	3.55	2.00	6.73
8	*Sida cordifolia*	10	0.20	2.00	0.24	0.59	2.82	3.64
9	*Ageratum conyzoides*	10	0.30	3.00	0.35	0.59	3.78	4.72
10	*Croton tiglium*	30	0.50	1.67	0.59	1.78	3.12	5.49
11	*Evolvulus alsinoides*	40	1.20	3.00	1.42	2.37	1.12	4.91
12	*Solanum nigrum*	40	1.10	2.75	1.30	2.37	1.12	4.79
13	*Datura metal*	30	1.00	3.33	1.18	1.78	1.53	4.48
14	*Achyranthes aspera*	90	6.90	7.67	8.15	5.33	1.12	14.60
15	*Tridax procumbens*	100	7.50	7.50	8.85	5.92	1.12	15.90
16	*Alternanthera sessilis*	80	2.50	3.13	2.95	4.73	2.00	9.68
17	*Euphorbia hirta*	50	1.50	3.00	1.77	2.96	1.12	5.85
18	*Withania somnifera*	20	0.50	2.50	0.59	1.18	1.76	3.53
19	*Ocimum gratissimum*	70	2.50	3.57	2.95	4.14	3.44	10.53
20	*Echinochloa colonum*	60	1.60	2.67	1.89	3.55	1.12	6.56
21	*Abutilon indicum*	20	0.70	3.50	0.83	1.18	2.82	4.83
22	*Aerva lantana*	10	0.50	5.00	0.59	0.59	1.12	2.31
23	*Ageratum Conyzoides*	10	0.30	3.00	0.35	0.59	1.32	2.26
24	*Amaranthus tricolor*	20	0.60	3.00	0.71	1.18	2.00	3.89
25	*Andropogon iwaraneusa*	30	0.70	2.33	0.83	1.78	0.50	3.10
26	*Boerhavia diffusa*	20	0.30	1.50	0.35	1.18	1.12	2.66
27	*Calotropis procera*	90	8.50	9.44	10.04	5.33	5.69	21.05
28	*Portulaca oleracea*	20	0.70	3.50	0.83	1.18	1.53	3.54
29	*Curculigo orchioides*	30	1.20	4.00	1.42	1.78	1.76	4.95
30	*Cynodon dacttylon*	80	7.30	9.13	8.62	4.73	0.94	14.30
31	*Cyperus rotundus*	10	0.70	7.00	0.83	0.59	1.32	2.74
32	*Eclipta alba*	50	2.50	5.00	2.95	2.96	2.53	8.44
33	*Euphorbia hirta*	50	4.20	8.40	4.96	2.96	2.82	10.73
34	*Hemidesmus indicus*	10	0.70	7.00	0.83	0.59	1.32	2.74
35	*Chloris barbata*	20	1.20	6.00	1.42	1.18	6.56	9.16
36	*Ipomoea purpurea*	20	0.80	4.00	0.94	1.18	1.12	3.25
37	*Gomphrena celosioides*	20	0.90	4.50	1.06	1.18	0.50	2.75
38	*Leucas cephalotes*	10	0.70	7.00	0.83	0.59	0.28	1.70
39	*Malvastrum coromandelianum*	10	0.40	4.00	0.47	0.59	0.78	1.84
40	*Ocimum americanum*	30	1.60	5.33	1.89	1.78	3.44	7.10
41	*Ocimum basilicum*	50	6.30	12.60	7.44	2.96	4.49	14.89
42	*Opuntia elatior*	30	1.80	6.00	2.13	1.78	2.25	6.15
43	*Oxalis acetosella*	20	0.80	4.00	0.94	1.18	2.53	4.66
44	*Phyllanthus fraternus*	30	1.50	5.00	1.77	1.78	3.44	6.99
45	*Sphaeranthus indicus*	10	0.50	5.00	0.59	0.59	2.53	3.71
46	*Tephrosia purpurea*	40	2.70	6.75	3.19	2.37	2.00	7.55
47	*Uraria picta*	10	1.10	11.00	1.30	0.59	1.12	3.01

3.1 Quantitative analysis

Frequency is a measure of the uniformity of the distribution of a species; thus a low frequency indicates that a species is either irregularly distributed or rare in a particular stand or forest [10]. The high percentage frequency exhibited by the species denotes their wide range of niche preferences and capability to establish over a large area. In the present investigation the maximum frequency was recorded for *Tridax procumbens* (100%) followed by Achyranthes aspera (90%), *Calotropis procera* (90%), *Eclipta prostrate* (80%), *Alternanthera sessilis* (80%), *Cynodon dacttylon* (80%) *Lantana camara* (70%), *Ocimum gratissimum* (70%) etc. Medium frequencies were recorded for Echinochloa colonum (60%), *Desmodium trifolium* (60%), *Euphorbia hirt* (50%),, *Evolvulus alsinoide* (40%), *Solanum nigrum* (40%), *Sonchus arvensis* (30%), etc.The lowest frequency value (10%) was recorded for *Sida cordifolia, Cyperus rotundus, Ageratum conyzoides* etc. The distribution of frequencies was shown in Figure1. Density is associate degree expression of the numerical strength of a species. The highest density was recorded by *Calotropis procera* (8.5) followed by *Tridax procumbens* (7.5), *Cynodon dacttylon* (7.3), *Achyranthes aspera* (6.9) Ocimum basilicum (6.3), *Euphorbia hirta* (4.2) *Ocimum gratissimum* (2.5), *Alternanthera sessilis* (2.5), *Eclipta prostrate* (1.8), Echinochloa colonum (1.6) etc. Abundance is that the study of the quantity of people or individuals of various species within the community per unit area. In the present study the highest abundance was recorded by *Ocimum basilicum* (12.60) followed by, *Uraria picta* (11), *Calotropis procera* (9.4), *Cynodon dacttylon* (9.13), *Euphorbia hirta* (8.4) etc.

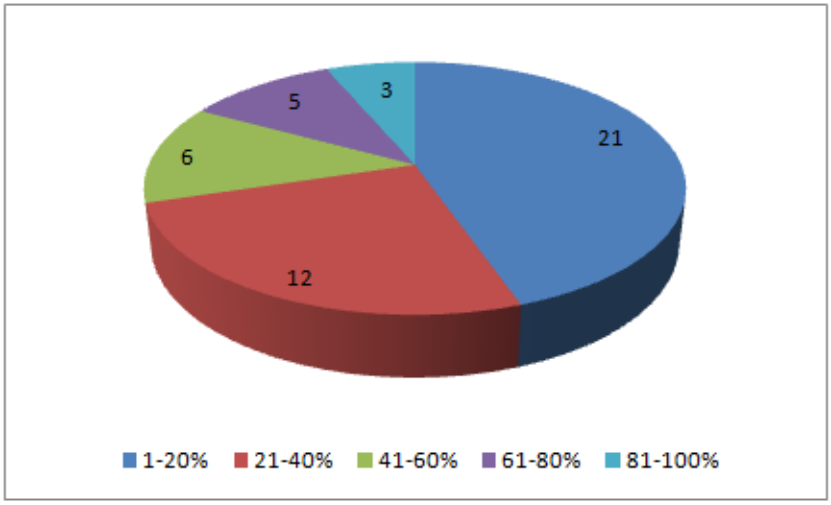

Fig. 1 Frequency class distribution of medicinal plant species.

3.2 Importance Value Index

The concept of Importance Value Index has been developed for expressing the dominance and ecological success of any species, with a single value [11]. The IVI depicts the phytosociological structure of a species in its totality in the community. The IVI is of great help in getting the overall picture of the ecological importance of a species. The IVI values ranged between 1.70-21.05.The dominant species in terms of IVI value in the open forests are *Calotropis procera* (21.05), *Tridax procumbens* (15.90), *Ocimum basilicum* (14.89) *Achyranthes aspera* (14.60), *Cynodon dacttylon* (14.30), *Euphorbia hirta* (10.73) and others (Fig. 2). Phytosociological studies also have been carried out by several workers in different region and forest of India. They studied the patterns of plant species diversity, regeneration and tree diversity in Uttar Pradesh [12, 13].

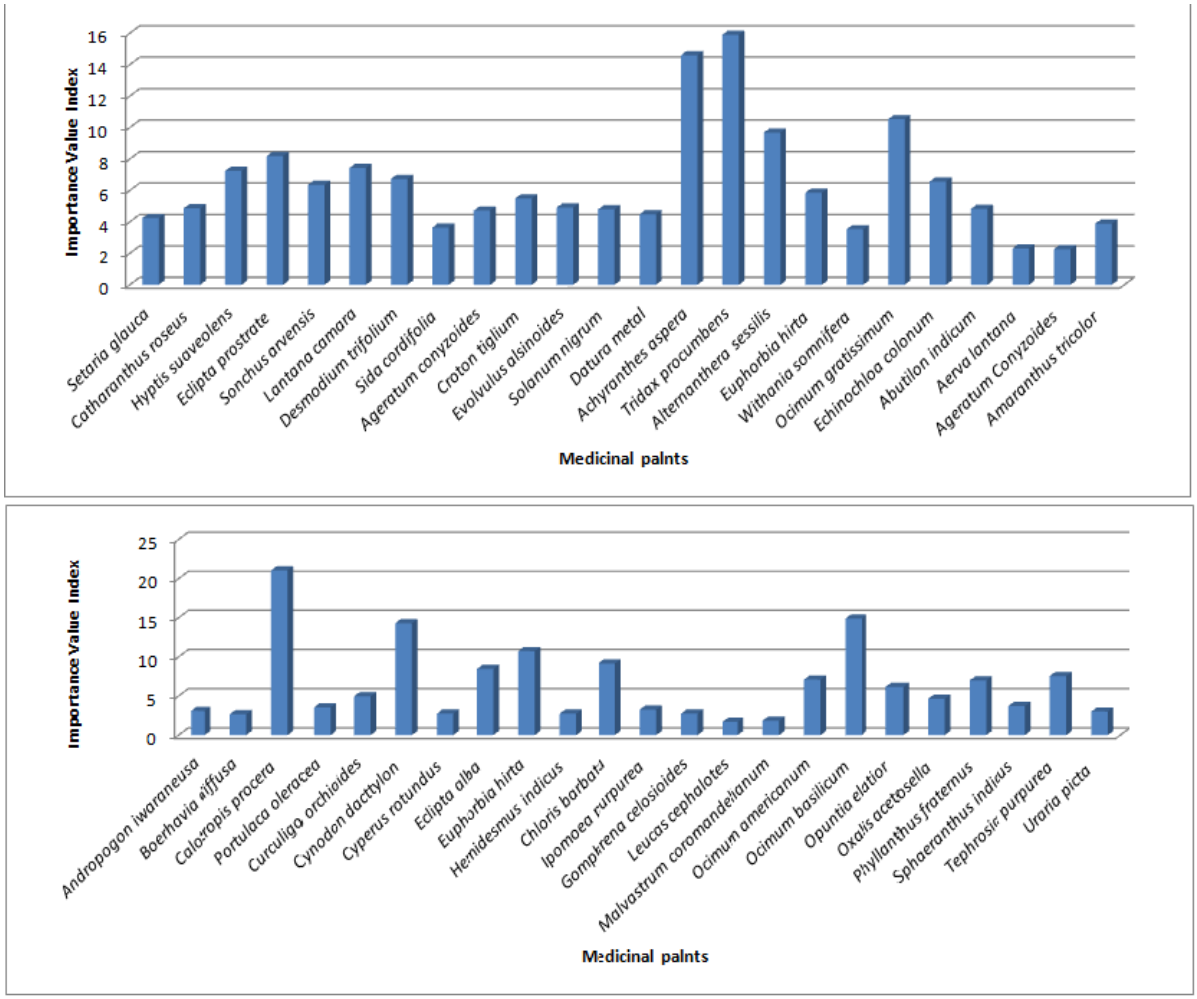

Fig. 2 Importance Value Index of medicinal plants.

4. Conclusion

Biodiversity is consecutive declining due to the jinks of human kind. The infrastructural developments such as roads, buildings, etc. greatly effects and altered the landscape ecology and natural resources which resulted into deforestation, habitat fragmentation, and destruction of plant communities from their natural habitats. Phytosociological studies with references to density, frequency, dominance and their relative values are essential for protecting the natural plant communities and biodiversity as well as understanding the changes experienced in the past and continued on in to the longer term. There is an urgent need for recognizing these historically valued natural systems at varied levels and designing or planning for their better management, ultimately going to conserve diverseness**.**

5. References

1. Jones and Stokes Associates. Sliding toward Extinction: The State of California's Natural Heritage, 1992. California Nature Conservancy, San Francisco, California, 1987.
2. Daily GC. Nature's Services. Societal Dependence on Natural Ecosystems. Island Press, Washington, DC.1997
3. Negi CS, Nautiyal S. Phytosociological studies of A Traditional Reserve Forest Thal Ke Dhar, Pithoragarh, Central Himalaya, India, Indian Forestry, 2005; 519-534.
4. Khare PK, Yadav VK, Mishra GP. Phytosociological structure of some forest communities in Central India, J. Trop. For., 1985; (4):321-326.
5. Singh JS, Singh SP, Gupta SR. Ecology, Environmental and Resource Conservation, Anamaya Publishers, New Delhi, 2006, 668.
6. Ahmed SA, Kadam JA, Patil SS, Baig MMV. Biological efficiency and nutritional contents of Pleurotus florida Singer cultivated on different agro-wastes, Nature and Science, 2009; (1):44- 48.
7. IGFRI. Annual Report. Indian Grassland and fooder Research institute, Jhansi, 2017, 40.
8. Curtis JT, McIntosh RP. The interrelation of certain analytic synthetic phytosociological characters. Ecology, 1950; 31: 43-445.
9. Curtis JT. The vegetation of Wisconsin: An ordination of plant comunioties. University Wisconsin press. Madison, Wis., USA, 1959.
10. Kharkwal G, Rawat YS. Structure and composition of vegetation in subtropical forest of Kumaun Himalaya, African J. of Plant Science, 2010; 4(4): 116-121.
11. Misra R. Ecology work book, Oxford and IBH Publications Co., New Delhi, 1968, 244.
12. Chauhan DS, Dhanai CS, Singh B, Chauhan S, Todaria NP, Khalid MA. Regeneration and tree diversity in natural and planted forests in a Terai - Bhabhar forest in Katarniaghat Wildlife Sanctuary, India, Tropical Ecology, 2008; 49(1): 53-67.
13. Shukla RP. Patterns of plant species diversity across Terai landscape in north eastern Uttar Pradesh, India, Tropical Ecology, 2009; 50(1): 111-123.