Ecological Studies on Some Common Medicinal Plants of Darjeeling Himalaya

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Abstract- *Medicinal plants are unique that are used by people for various purposes but the main aim is to use these plants by local people for curing ailments and to develop immunity. Since time immemorial plants are the source of various micro and macro nutrients even a source of vitamins, alkaloids, and terpenoids. Not only to cure ailments of people, there are many medicinal plants direct used by people in the market to earn money. Medicinal plants are therefore very important in any area. In hills, these plants are similarly used by tribal people. Due to degradation of land and habitat, plants are threatened from any area and that need conservation too. So, conservation point of view, the ecological status of medicinal plants is important to record this in-situ habitat. In this communication, some herbaceous medicinal plants of Darjeeling Govt. College campus and nearby areas have been communicated. These will develop general idea to conserve the medicinal plants in near future and side by side people will take initiative to study more and more to know the status of plants on the basis of ecological amplitude.*

Keywords- Some herbaceous medicinal plants, Ecological status, Darjeeling district.

I. INTRODUCTION

Phyto-sociology is a common term applied in ecology to know the actual status of any vegetation. It is also applied in case of medicinal plant studies. To know the herbaceous medicinal plant diversity, the present study was taken into account. Here, frequency, density and dominance indices were recorded in diverse sloppy habitats in the study area of Darjeeling Himalaya (Fig. 1). Present study therefore aimed to identify the ecological status in terms of importance value index, and ultimately various indices to measure the threats in near future.

II. STUDY AREA

Darjeeling Govt. College campus and adjoining Padmaja Naidu Himalayan Zoological Park adjacent to Govt. College Campus was taken as study area. Darjeeling Govt. College was established in the Eastern Himalayan Hill range in the year 1948 and functioning to promote higher education to the community of hill and plain people in the country. The College has its unique position to deliver knowledge to the community in and around North East India, nay to Darjeeling and Sikkim Himalayan people. The campus is adjacent to Darjeeling Himalayan Zoo, and unique position between the Hooker's road and lower Hill Cart Road. Similarly, Padmaja Naidu Himalayan Zoological Park was established in the year 1958 in the Himalayan range of Indian sub-continent.

Vegetation of the two institutional campus and surrounding areas cover species like *Rhododendron*, *Castanopsis, Alnus, Juniperus, Cupressus, Pinus, Elaeocarpus, Acer oblongum, Acer campbelii, Saurauria, Taxus, Abies, Michelia, Camellia* and *Magnolia* trees. Herbaceous plant species found in the campus and adjoining area are *Polygonum, Geranium, Trifolium, Galium, Calceolaria, Erigeron* etc. Temperature varies from 2.4 to 18 degree Celsius. Annual rainfall of the study area is 2981.8 mm and number of rainy days is 78.

III. MATERIALS AND METHODS

During studie, in total 5 plots in each site were selected at random way. Each station demarcated and quadrat was framed to study the vegetation using standard method used in ecology. Five study points in each station (1m X 1m for herbs) were selected for regular monitoring of status of different medicinal plants.

Eecological studies:

Vegetation in a community is a dynamic biological system consisting of a number of plant and animal species. Vegetation at a particular site is the result of interaction of various climatic and biotic (faunal also) as well as edaphic (soil) factors. During the course of succession, many herbaceous species compete with each other to establish their hold on the vacant niches. Consequently, some tree species occupy the top position and become dominant in the community and others are either contented with their lower phyto-sociological status or eliminated from the system. So, as a whole there are some factors that govern the complete process, through which flora and fauna of wild species sit

together and also possess their special interactions through co-existence.

Ssynthetic characters:

The vegetation survey was made in the sites selected by laying quadrats at random. Vegetation data of the above mentioned sites situated in study sites In open tract the vegetation study was made by quadrat as per the "landscape" approach. The size of the quadrat was fixed by method of "species area curve" (Oosting, 1958).

The numbers of quadrats required were determined by plotting the number of species against the number of quadrats. The quadrat analyses were made following Dombois and Ellenberg (1974). Quadrats of 1m x 1m for herbs were laid down at random for study of vegetation. Frequency density and abundance values were calculated for each species. The importance value index (IVI), an integrated measure of relative frequency, relative density and relative dominance were derived following Curtis (1959).

Indices study:

Diversity index $\overline{(H)}$ of each sample stand was calculated as Shannon and Wiener (1963).

$$\overline{(H)} = -\sum [(ni / N). Ln (ni / N)]$$

Where 'ni' is the IVI of individual species and 'N' is the total IVI of all the species.

Concentration of Dominance (Cd) of each stand was calculated following the formula given below by Simpson (1949).

$$Cd = (ni / N)^2$$

Where 'ni' is the IVI of individual species and 'N' is the total IVI of all the species.

Evenness Index (e) was calculated according to Pielou (1966).

$$e = \overline{H} / \log S$$

Where, $\overline{H}$ = Shannon index and S = Number of species.
Species Richness index (d) was calculated according to Margalef (1958).

$$d = S-1 / \log N.$$

Where, S= Number of species, N = Importance Value and d= Species richness.

Literature used in the study mentioned in the references part [1-32].

IV. RESULT AND DISCUSSION

The present study revealed that study site showed 6 medicinal plants of potential importance.

Among the 9 plants studied, 6 plants were used tremendously by the local people of Darjeeling. Ecologically *Drymera cordata* (Caryophyllaceae) having highest Importance Value Index (IVI) i.e., 46.29 followed by *Eupatorium adenophorum* (Asteraceae) i.e., 46.8 and the lowest IVI value was observed in case of *Impatiens arguta* (IVI=9.23). Diversity Index of the plant in the study site was 1.5 while concentration of dominance was 0.12. Here, some obnoxious weeds were observed which interfacing as obnoxious elements that they always interfaced the growth of the vegetation during monsoon. As a whole evenness index and the richness index of the species in the study station was 1.64 and 3.30 respectively (Table 1).

Table 1 Ecological Status of Medicinal plants at Darjeeling Govt. College Campus, W.B., near Geography Department.

SL.NO	NAME OF PLANTS	MEAN	R.F	R.Den	R.Dom	IVI	ni/N	$(ni/N)^2$	Logni/N	-ni/N * Logni/N
1	*Calciolaria maxicana*	8	8	2.5	10.5	21	0.07	0.006	1.1	0.07
2	*Drymeria cordata*	16	16	25	5.29	46.29	0.17	0.029	0.76	0.13
3	*Eregeron bellilioides*	16	16	22.5	5.29	43.79	0.16	0.025	0.77	0.12
4	*Pielea umbrosa*	12	12	5	1.27	18.27	0.06	0.004	1.22	0.07
5	*Impatiens arguta*	4	4	2.5	2.73	9.23	0.03	0.001	1.11	0.03
6	*Eupatorium adenophoram*	12	12	7.5	27.3	46.8	0.17	0.03	0.76	0.13
7	*Plantago ovate*	8	18	10	10.5	28.5	0.1	0.01	1	1.0
8	Member of Poaceae	16	16	22.5	2.73	41.23	0.15	0.02	0.82	0.01
9.	*Stellaria media*	8	8	2.5	2.73	13.23	0.04	0.002	1.39	0.002
						268.34	0.95	**0.12**	6.95	**1.562**

[*N.B: R.F- Relative frequency; R. Den- Relative density; R. Dom-Relative dominance; IVI-Importance Value Index; ni-IVI of individual species; N-Total IVI of Species, Diversity Index=1.56, Dominance Index =0.12, Evenness Index=1.64, Richness Index=3.30*]

The present study revealed that study site having 4 medicinal plants of potential importance. Among the 6 plants studied, only 4 plants were used tremendously by the local people of Darjeeling. Ecologically *Pielea umbrosa* having

highest Importance Value Index (IVI) i.e., 74.42 followed by *Eregeron bellilioides* (Asteraceae) i.e., 64.04 and the lowest IVI value was observed in case of *Calciolaria* sp (IVI=9.23). Diversity Index of the plant in the study site was 0.71 while concentration of dominance was 0.17. Here, some obnoxious weeds were observed that interfacing as obnoxious elements that they always interface the growth of the vegetation during monsoon. As a whole evenness index and the richness index of the species in the study station was 0.92 and 2.02 respectively (Table 2).

Table 2 Ecological Status of Medicinal plants in College Campus near College Canteen.

SL NO.	NAME OF THE PLANTS	MEAN	R.F	R.Dom	R.Den	IVI	ni/N	$(ni/N)^2$	Logni/N	-ni/N* Log ni/N
1	*Oxalis corniculata*	4	23.52	21.05	8.95	53.52	0.17	0.287	0.76	0.12
2	*Pielea umbrosa*	2	17.64	10.52	46.26	74.42	0.24	0.0576	0.61	0.14
3	*Eregeron bellilioides*	6	23.52	31.57	8.95	64.04	0.21	0.044	0.67	0.14
4	*Calciolaria sp*	1	5.88	5.26	17.91	29.05	0.09	0.008	1.04	0.09
5	*Drymeria cordata* (Fig. 3)	1	23.52	5.26	8.95	37.73	0.12	0.014	0.92	0.11
6	*Fagopyron sp*	5	5.8	26.31	8.95	41.14	0.13	0.016	0.88	0.11
		19	99.96	99.96	99.97	299.9	0.96	0.17	4.88	0.71

[*N.B: R.F- Relative frequency; R. Den- Relative density; R. Dom-Relative dominance; IVI-Importance Value Index; ni-IVI of individual species; N-Total IVI of Species, Diversity Index=0.71, Dominance Index =0.17, Evenness Index=0.922, Richness Index=2.02*]

The present study revealed that study site having 1 medicinal plants of potential importance. Among the 5 plants studied, only 1 plant is used tremendously by the local people of Darjeeling. Ecologically *Hypoistis sp* (Lamiaceae) having highest Importance Value Index (IVI) i.e., 69.90 followed by *Eregeron bellilioides* (Asteraceae) i.e., 59.70 and the lowest IVI value was observed in case of *Globba ophioglossa* (IVI=9.23). Diversity Index of the plant in the study site was 0.65 while concentration of dominance was 0.17. Here, some obnoxious weeds are observed which the interfacing elements are known so far that they always interface the growth of the vegetation during monsoon. As a whole evenness index and the richness index of the species in the study station was 0.94 and 1.61 respectively (Table 3).

Table 3 Ecological Status of Medicinal plants in College Campus near Nepali Department.

SL NO	NAME OF THE PLANTS	MEAN	R.F	R.Den	R.Dom	IVI	ni/N	$(ni/N)^2$	Log ni/N	-ni/N*Log ni/N
1	*Globba ophioglossa*	2	12.5	11.76	0.36	24.62	0.2	0.04	0.69	0.13
2	*Hypoistis sp*	3	25	23.52	21.38	69.90	0.23	0.05	0.63	0.14
3	*Polygonum sp*	3	18.75	17.64	15.27	51.66	0.17	0.02	0.76	0.12
4	*Pielea umbrosa*	3	18.75	17.64	21.38	57.67	0.19	0.03	0.72	0.13
5	*Eregeron bellilioides*	5	25	29.41	5.29	59.70	0.19	0.03	0.72	0.13
			100	99.87	99.97	299.84	0.98	.17	3.52	0.65

[*N.B: R.F- Relative frequency; R. Den- Relative density; R. Dom-Relative dominance; IVI-Importance Value Index; ni-IVI of individual species; N-Total IVI of Species, Diversity Index=0.65, Dominance Index =0.17, Evenness Index=0.94, Richness Index=1.61*]

The present study revealed that study site having 3 medicinal plants of potential importance. Among the 6 plants studied only 3 plants are used tremendously by the local people of Darjeeling. Ecologically *Pielea umbrosa* () having highest Importance Value Index (IVI) i.e. 81.25 followed by *Primula* sp (Primulaceae) i.e. 55.14 and the lowest IVI value was observed in case of *Galium aperine* (IVI=30.24). Diversity Index of the plant in the study site was 0.72 while concentration of dominance was 0.15. Here some obnoxious weeds were observed which were interfacing elements and are known so far that they always interface the growth of the vegetation during monsoon. As a whole evenness index and the richness index of the species in the study station was 0.19 and 2.02 respectively (Table 4).

Table 4 Ecological Status of Medicinal plants in Darjeeling Govt. College Campus near Botany Garden.

SL NO	NAME OF THE PLANTS	MAEN	R.F	R.Den	R.Dom	IVI	ni/N	$(ni/N)^2$	Logni/N	-ni/N*Log ni/N
1	*Hydrocotyl javonica*	6	15	17.64	3.48	36.12	0.122	0.01	0.92	0.11
2	*Calciolaria sp*	5	15	14.70	19.76	49.46	0.16	0.02	0.79	0.12
3	*Pielea umbrosa* (Fig. 4)	7	20	20.56	40.69	81.25	0.27	0.07	0.56	0.15
4	*Primula sp*	8	20	23.52	11.62	55.14	0.18	0.03	0.74	0.13
5	*Eregeron bellilioides*	4	15	11.52	16.27	43.03	0.14	0.01	0.85	0.11
6	*Galium aperine*	4	15	11.76	3.48	30.24	0.1	0.01	1	0.1
		34	100	99.94	95.3	295.24	0.97	0.15	4.80	0.72

[N.B: R.F- Relative frequency; R. Den- Relative density; R. Dom-Relative dominance; IVI-Importance Value Index; ni-IVI of individual species; N-Total IVI of Species, Diversity Index=0.72, Dominance Index =0.15, Evenness Index=0.19 Richness Index=2.02]

The present study revealed that study site having 4 medicinal plants of potential importance. Among the 4 plants studied, all plants are used tremendously by the local people of Darjeeling. Ecologically *Eregeron bellilioides* (Asteraceae) having highest Importance Value Index (IVI) i.e., 128.2 followed by *Urtica dioica* (Urticaceae) i.e., 109.25 and the lowest IVI value is observed in case of *Calamintha* sp. (IVI=28.62) a member of Lamiaceae. Diversity Index of the plant in the study site was 0.67 while concentration of dominance was 0.30. Here, some obnoxious weeds are observed which the interfacing elements are known so far that they always interface the growth of the vegetation during monsoon. As a whole evenness index and the richness index

of the species in the study station was 1.11 and 1.21 respectively (Table 5).

Table 5 Ecological Status of Medicinal plants near Zoological park, Darjeeling, W.B.

SL. NO	NAME OF PLANTS	MEAN	R.F	R.DEN	R.DOM	IVI	ni/N	$(ni/N)^2$	Log ni/N	-ni/N* Log ni/N
1	*Urtica dioica* (Fig. 5)	3	25	15.78	68.47	109.25	0.96	0.12	0.92	0.33
2	*Eregeron bellilioides*	13	50	68.42	9.78	128.2	0.42	0.17	0.37	0.15
3	*Poulzalzia sp*	2	12.5	10.52	10.86	33.88	0.11	0.01	0.95	0.1
4	*Calamintha* sp. (Fig. 2)	1	12.5	5.26	10.86	28.62	0.09	0.008	1.04	0.09
						299.95	0.98	0.3081	3.28	0.67

[N.B: R.F- Relative frequency; R. Den- Relative density; R. Dom-Relative dominance; IVI-Importance Value Index; ni-IVI of individual species; N-Total IVI of Species, Diversity Index=0.67, Dominance Index =0.30, Evenness Index=1.11, Richness Index=1.21]

Major findings: It is argued that highest Diversity index of medicinal plants was observed near Geography Department (1.56) and lowest near Nepali Department (0.65). Highest dominance index of species was observed near Zoo park (0.30) and lowest near Geography Department (0.12). Highest species richness index was observed near Geography Department (3.30) and lowest near Zoo park (1.21). Highest evenness index of species was observed near Geography department (1.64) and lowest near Botany garden (0.19).

V. CONCLUSION

Eastern Himalaya is a treasure of medicinal plants. Due to its unique climatic factors various medicinal plants are observed here. In the study site many medicinal plants are available but due to small patch study only a few are included in the table. Tree and shrubby species are excluded though *Urtica dioica* plant is a shrubby medicinal plant included in the quadrat which was found as herb. In market flowering twigs are available and widely used by people to cure rheumatism and gut pain (Fig. 5). Diversity varies from site to site (Fig. 6) though seasonal impact mostly influences the vegetation too. To establishing the actual degradation process on medicinal plants, need continuous study i.e. study year after year to access the status of vegetation in a long term basis particularly on the medicinal plants. It is therefore recommended that various organization and academic institutes would take action plan for more study in various parts of Darjeeling hills in Eastern Himalaya (Fig. 7).

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Photographs (1-8)

Fig. 1 View of Darjeeling Hills from Kanchenjunga view point towards Lebong, W.B.

Fig. 2 *Calamintha* sp.

Fig. 3 *Drymeria cordata* –Abijal

Fig. 4 *Pielea umbrosa*

Fig. 5 Woman selling medicinal plant (flowers of *Urtica dioica*) in the Darjeeling open market.

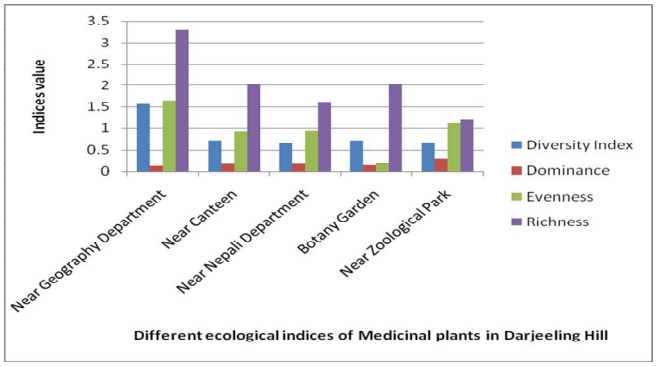

Fig. 6 Different indices of medicinal plants at 5 study sites in and around the Darjeeling Govt. College, W.B.

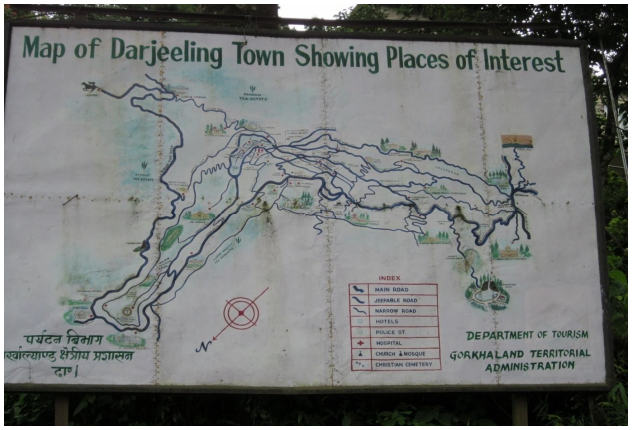

Fig. 7 Map of the Darjeeling Himalaya, W.B.

Fig. 8 Medicinally important Vegetable in the Mall market, Darjeeling, W.B.

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