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Community Composition and Distribution Pattern of Herbaceous Flora in Holi Area of District Chamba in Himachal Pradesh

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Abstract

The present study was carried out in Holi Forest Range of district Chamba, which is the north-west district of Himachal Pradesh and is located between latitude 32°17'412'' to 32°26'541''N and longitude 76°31'504'' to 76°35'385''E. The territory is completely mountainous with altitude varying from about 2,000 feet (610 m) to about 21,000 feet (6,400 m) above the mean sea level. The quantitative information of herbs was collected from different sites i.e., Deol, Kut, Dal, Lahaud Dhar. Frequency (%), Density (plants m^{-2}), Basal Area (cm^2), Importance Value Index (IVI) and A/F ratio of plant species at different sites were recorded. *Poa alpina* was found to have highest frequency (90%) closely followed by *Jurinea dolomiaea* (80%) and *Biebersteinia odora* has the lowest frequency of 10%. *Poa alpina* has the highest density (60.6 plants m^{-2}) at Dal followed by *Gentiana kurrooa* (35.8 plants m^{-2}). *Moschela esculenta* was found to have highest basal area (1.234 cm^2) at Kut. *Viola serpens* was the dominant species with highest value of IVI (78.77) closely followed by *Poa alpina* (65.91), *Gentiana kurrooa* (65.37) and *Jurinea dolomiaea* (65.36). Most of the species were distributed randomly followed by contagious pattern of distribution and least species were reported for regular distribution pattern.

Keywords: A/f ratio, basal area, herbaceous flora, importance value index

1. Introduction

Chamba district of Himachal Pradesh is considered as one of the richest area of traditional and potential medicinal wealth. The district is bounded by Kangra district of Himachal Pradesh and Gurdaspur district in the south of Punjab, Jammu and Kashmir in the north and Lahaul Spiti in the west. The district has two tribal regions, viz., Pangi and Bharmour. Bharmour is situated in the west of this district, whereas Pangi Valley is situated in the north. The vegetation of the district Chamba varies considerably, chiefly owing to elevation and rainfall variations.

The unprecedented rate of species extinction in recent times projects about quarter of the global species to be lost or threatened by the middle of 21st century (Raven, 1990). With growing global concern for species endangerment, especially over the past two decades, the term biodiversity has encouraged conservationists to look for causes and consequences of species extinction and finding ways for their conservation. Human activities and unsustainable harvesting in the wild have been identified as one of the biggest causes of reported phenomenal loss of species (Lewin, 1986; Wilson, 1988). The recent IUCN Red List sampled 91% plant species as threatened due to habitat loss and degradation (Hilton, 2000). India is ranked at sixth place for having the largest number of threatened plant species in the above IUCN Red List. It is well understood to extinction and by understanding the processes that contribute to their rarity, future loss of diversity may be deferred or reduced (Flather et al., 1994).

With growing awareness of the people towards the use of herbal medicine during mid 1980s to the 1990s, about 233 major pharmaceutical companies globally became involved in screening of plants for new leads (Aryal, 1993). Nearly 2,500 wild plant species are reported in use for medicinal purpose in Indian subcontinent, of which, possibly about 300 taxa are used in 8,000 licensed pharmaceuticals in India (Ahmad, 1993). In recent years, India has emerged as one of the biggest suppliers of raw material (Holley and Cherla, 1998) ranking second amongst 12 world leading exporter countries (Lange, 1997). Collection of medicinal herbs as Minor Forest Produce (MFP) under forest law as traditional rights in designated forest land (Anderson, 1886) has been an important source of the native's income in Himachal Himalaya (Dobriyal et al., 1997; Tandon, 1997; Badola, 1998, 2002).

A rough estimate and secondary sources suggest availability of about 1,000 to 1,200 medicinal plant species in Himachal Himalayas (Gupta, 1964, 1971; Gaur and Singh, 1993;

Chauhan, 1999; Badola, 2001). As per the habitat type, these share 18% trees, 21% shrubs, 55% herbs in composition, which coincides more or less with that of Indian Himalayan Region, having 23%, 22% and 58% species of trees, shrubs and herbs, respectively (Samant et al., 1998).

Kumar et al. (2010) carried out a study of ecological status of ethno medicinal plants in the Garhwal Himalaya. The northern part of India harbours a great diversity of medicinal plants due to its distinct geography and ecological marginal conditions. They reported total of 57 species, including 14 trees, 10 shrubs and 33 herbs. Regular and random distribution pattern of species reflect the higher biotic pressure in terms of grazing and lopping in natural forest stands (Kumar et al., 2010). Shameem and Kangroo (2011) carried out a study in Dachigam National Park, Kashmir Himalaya, India reported that most of the species in their study were distributed contagiously. The studies carried out by Shadangi and Nath (2005) also gave similar findings of contagious distribution pattern of species.

In Study area, it has been reported that a number of species like *Angelica gluaca*, *Picrorhiza kurroo, Jurinea dolomiaea* and *Podophyllum hexandrum* are under the threat of extension (Dinanath, 2007). This calls upon the taxonomists and economic botanists to undertake systematic studies on the existing flora to identify and inventoried the medicinal and aromatic plant species enabling the scientists, planners and administrators to initiate effective steps for their conservation and sustainable utilization, otherwise the area may lose some of these species forever. Furthermore, tribal people residing in the study area, since thousands of years have been interacting with the flora and have evolved their own traditional healing methods, relying heavily on local medicinal plant resources (Karki and Willians, 1999). There is no proper record available regarding the community composition and distribution of the medicinal plant diversity of Holi area. Keeping these factors in view, the present study was carried out with the objective to study community composition and distribution pattern of herbaceous flora.

2. Materials and Methods

The present study was carried out in Holi Forest Range of district Chamba, which is located between latitude 32°17'412'' to 32°26'541'' N and longitude 76°31'504'' to 76°35'385''E. Extensive field survey of the selected areas of Holi starting from the lower elevation at Deol (2,300-2800 m), Kut (2,800-3300 m), Dal (3,300-3800 m) and Lahaud Dhar (3,800 m and above) under Holi Forest Range was carried out (Table 1 and Figure 1).

For the vegetation analysis of herbaceous layer, a total of 160 plots of 1x1 m size quadrate laid out randomly in the study area. Species richness was simply taken as a count of number of species present in that forest type. The vegetation data were quantitatively analyzed for density, frequency and abundance (Curtis and McIntosh, 1950). Importance Value

Table 1: Location of study sites

Forest range	Site	Altitude (m)	Coordinates	
			Longitude	Latitude
Holi	Deol	2300-2800	32018"079'N	076035"262'E
	Kut	2800-3300	32017"488'N	076034"870'E
	Dal	3300-3800	32017"412'N	076032"342'E
	Lahaud Dhar	3800 and above	32017"208'N	076032"002'E

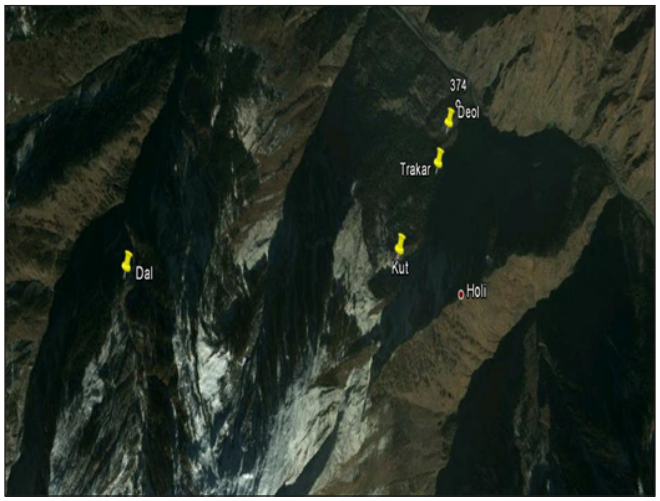

Figure 1: Sites of study area (Holi)

Index (IVI) was calculated using the sum of relative frequency, relative density and relative dominance (Phillips, 1959). The quantitative analysis for different parameters was calculated as follows:

Frequency (%)

Frequency indicates the number of sampling units in which a given species occur. Percent frequency was calculated as follows:

Frequency (%)=(No. of sampling units in which species occurred÷Total number of sampling units studied)×100

Density

It represents the numerical strength of species in a community. Density was calculated as follows:

Density= (Total number of indivuduals of a species in all sampling units÷Total number os sampling units studies)×100

Abundance

Abundance is analyzed to get an idea of distribution pattern of the species.

Abundance=(Total number of individuals of a species in all sampling units÷Total number of sampling units in which species occurred)

Basal area

Basal area is the area of ground actually penetrated by the stems, and is readily seen when the leaves and stems are clipped at the ground surface. Basal area of herbs was measured at the ground level which is calculated as:

Basal area=πr^2

Importance value Index (IVI)

The IVI which is an integrated measure of the relative frequency, relative density and relative basal area, was calculated from the basic data for each species of herbs (Phillips, 1959) as:

Importance value index=Relative frequency+relative density+relative dominance

The relative values of frequency, density and basal area was calculated as follows:

Relative frequency=(Frequency of individual speices÷Frequency of all speices)×100

Relative density=(Density of individual speices÷Density of all speices)×100

Relative dominance=(Basal area of individual speices÷Basal area of all speices)×100

Abundance to frequency ratio

Abundance to Frequency ratio (A/F ratio) for different species was determined for eliciting the distribution pattern. The distribution pattern of species is considered regular if ratio is <0.025, random if ratio between 0.025-0.05 and contagious if ratio >0.05 (Curtis and Cottam, 1956; Whitford, 1949) as:

A/F ratio = Abundance÷Frequency

3. Results and Discussion

Frequency, density, basal area and importance value index of plant species at Deol are presented in Table 2. It has been observed that *Diplazium esculantum* has the highest frequency (70%) closely followed by *Lecanthus peduncularis* and *Morchella esculenta* (60% each) whereas, *Ainsliaea aptera* has the lowest frequency (10%). *Nasturtium officinale* has the highest density (10.0 plants m^{-2}) followed by *Fagopyrum esculentum* (6.2 plants m^{-2}) whereas, *Ainsliaea aptera* has the lowest density (0.2 plants m^{-2}). *Verbascum cylindericum* was found to have highest basal area (0.622 cm^2) followed by *Artemisia vulgaris* (0.520 cm^2) whereas, *Chrysopogon gryllus* and *Cynodon dactylon* has the lowest basal area (0.002 cm^2). *Morchella esculenta* has the highest value of IVI (16.58) followed by *Diplazium esculantum* (13.77) whereas, *Ainsliaea aptera* has the lowest value of IVI (0.85). Thus, depicting that *Morchella esculenta* was the dominant species, *Diplazium esculantum* codominant and *Ainsliaea aptera* the associated species. At Deol, the highest numbers of species

Table 2: Frequency, density, basal area and importance value index of plant species at Deol

Sr. No.	Species	Frequency (%)	Density (plants m^{-2})	Basal Area (cm^2)	IVI	A/F ratio
1	*Ainsliaea aptera*	10	0.2	0.012	0.85	0.020
2	*Amaranthus paniculatus*	20	0.9	0.080	2.61	0.005
3	*Arisaema flavum*	20	2.0	0.311	5.33	0.100
4	*Artemisia brevifolia*	20	0.5	0.487	5.01	0.025
5	*Artemisia vulgaris*	40	1.0	0.520	6.87	0.025
6	*Arundinella nepalensis*	20	0.4	0.319	3.80	0.020
7	*Aster diplostephioides*	20	0.5	0.311	3.80	0.025
8	*Aster himalaicus*	20	0.4	0.317	3.74	0.020
9	*Bistorta amplexicaulis*	30	0.8	0.020	2.66	0.027
10	*Bistorta impleriscor*	40	1.2	0.026	3.67	0.030
11	*Cannabis sativa*	30	1.1	0.518	6.40	0.037
12	*Capllipedium parviflorum*	20	0.8	0.499	5.41	0.040
13	*Carum carvi*	30	3.1	0.013	4.94	0.103
14	*Chaerophyllum reflexum*	30	0.6	0.011	2.39	0.020
15	*Chenopodium album*	20	0.8	0.468	5.19	0.040
16	*Chrysopogon gryllus*	40	2.6	0.002	4.92	0.065
17	*Coriandrum sativum*	20	1.3	0.015	2.57	0.065
18	*Cyathula capitata*	20	0.4	0.485	4.90	0.020
19	*Cynodon dactylon*	30	1.1	0.002	2.83	0.037
20	*Diplazium esculantum*	70	6.1	0.519	13.77	0.087
21	*Diplazium polypodioides*	30	1.2	0.502	6.39	0.040

Table 2: Continue...

Sr. No.	Species	Frequency (%)	Density (plants m^{-2})	Basal Area (cm^2)	IVI	A/F ratio
22	*Dryopteris nigropalaceum*	50	0.7	0.011	3.62	0.014
23	*Equesetum arvensis*	20	0.8	0.469	5.20	0.020
24	*Fagopyrum dibotrys*	20	0.6	0.492	5.15	0.030
25	*Fagopyrum esculentum*	40	6.2	0.485	11.93	0.155
26	*Foeniculum vulgare*	20	0.3	0.312	3.61	0.015
27	*Fragaria vesca*	40	1.4	0.300	5.77	0.035
28	*Galium triflorum*	20	1.1	0.435	5.27	0.055
29	*Geranium robertianum*	30	0.8	0.238	4.17	0.027
30	*Impetiens balsamina*	20	0.4	0.219	3.07	0.020
31	*Impetiens laxiflora*	20	0.5	0.208	3.09	0.025
32	*Inula cuspidate*	30	1.3	0.478	6.33	0.043
33	*Lecanthus peduncularis*	60	5.4	0.499	12.35	0.090
34	*Malva gulsausan*	20	0.6	0.058	2.15	0.030
35	*Melilotus officinalis*	30	0.8	0.034	2.76	0.027
36	*Mentha longifolia*	40	3.4	0.488	9.11	0.085
37	*Mentha viridis*	30	6.0	0.348	10.21	0.200
38	*Microstegium nudum*	30	0.8	0.011	2.60	0.027
39	*Morchella esculenta*	60	2.8	1.493	16.58	0.047
40	*Nasturtium officinale*	40	10.0	0.012	12.53	0.250
41	*Ranunculus hirtellus*	20	0.8	0.022	2.11	0.040
42	*Rumex nepalensis*	30	2.0	0.317	5.92	0.067
43	*Sanicula europaea*	40	3.6	0.013	6.03	0.090
44	*Senecio chrysenthemoides*	50	3.7	0.015	6.71	0.074
45	*Siegesbeckia orientalis*	20	0.6	0.020	1.89	0.030
46	*Silene cucubalus*	20	0.3	0.018	1.57	0.015
47	*Silene edgeworthii*	30	0.5	0.021	2.36	0.017
48	*Silene viscose*	20	0.4	0.026	1.73	0.020
49	*Stellaria aquatic*	30	0.3	0.032	2.23	0.010
50	*Stellaria crispate*	20	0.7	0.041	2.13	0.350
51	*Taraxacum officinale*	30	0.8	0.018	2.64	0.027
52	*Themeda anathera*	30	1.2	0.007	2.97	0.040
53	*Trifolium repense*	20	2.7	0.012	3.97	0.135
54	*Tulip stilata*	20	0.3	0.047	1.78	0.015
55	*Urtica dioca*	20	1.5	0.312	4.83	0.075
56	*Urtica parviflora*	30	1.3	0.330	5.31	0.043
57	*Valeriana jatamansi*	40	1.8	0.401	6.87	0.045
58	*Verbascum cylindericum*	20	0.3	0.622	5.75	0.015
59	*Viola pilosa*	30	3.4	0.075	5.76	0.113
60	*Viola serpens*	40	1.0	0.070	3.89	0.025
	Total		98.1	14.446		

were distributed randomly followed by contagious pattern of distribution and lowest species were distributed regularly.

Frequency, density, basal area and importance value index at Kut, are shown in Table 3. *Viola serpens* was found to have highest frequency (70%) closely followed by *Valeriana jatamensii* (60%) whereas, *Artica parviflora* has the lowest frequency (10%). *Viola serpens* was found to have highest density (85.5 plants m^{-2}) followed by *Valeriana jatamensii* (5.8 plants m^{-2}) whereas, *Artica parviflora* has the lowest density (0.5 plants m^{-2}). *Moschela esculenta* was found to have highest basal area (1.234 cm^2) followed by *Gentiana karrooa* (0.656 cm^2) whereas, *Agrostis species* has the lowest basal area

Table 3: Frequency, density, basal area and importance value index of plant species at Kut

Sr. No.	Species	Frequency (%)	Density (plants m^{-2})	Basal Area (cm^2)	IVI	A/F ratio
1	*Achillea millefolium*	20	0.6	0.020	2.21	0.030
2	*Agrimonia pilosa*	20	0.8	0.060	3.23	0.040
3	*Agrostis species*	20	1.2	0.002	2.02	0.060
4	*Ajuga bracteosa*	20	1.5	0.052	3.31	0.075
5	*Angelica glauca*	30	2.0	0.064	4.55	0.067
6	*Artemisia roxburghii*	40	4.5	0.279	11.33	0.113
7	*Artica parviflora*	10	0.5	0.023	1.49	0.051
8	*Artemisia absinthium*	30	3.5	0.200	8.33	0.117
9	*Bistorta amplexicaulis*	20	0.8	0.012	2.10	0.040
10	*Bupleurum falcatum*	20	0.6	0.006	1.88	0.030
11	*Bupleurum tenue*	20	0.7	0.013	2.08	0.035
12	*Cassiope fastigiata*	30	1.1	0.021	3.18	0.037
13	*Chaerophyllum villosum*	20	1.3	0.030	2.02	0.065
14	*Chrysopogon gryllus*	50	3.8	0.005	5.38	0.076
15	*Corydalis crasissima*	30	2.1	0.043	4.10	0.070
16	*Cotoneaster macrophylla*	20	0.9	0.034	2.66	0.045
17	*Cremanthodium reniforme*	20	0.8	0.065	3.34	0.040
18	*Cynoglossum microgluchin*	20	0.6	0.029	2.42	0.030
19	*Fragaria vesca*	50	3.6	0.017	5.58	0.072
20	*Gentiana karrooa*	40	1.2	0.656	18.85	0.030
21	*Geum elatum*	30	0.7	0.033	3.31	0.023
22	*Gynura cusimbua*	30	0.8	0.025	3.17	0.040
23	*Hackelia uncinata*	20	0.9	0.054	3.81	0.045
24	*Heracleum candicans*	20	0.7	0.032	2.53	0.035
25	*Inula cappa*	30	1.2	0.087	4.77	0.040
26	*Inula hookeri*	20	0.8	0.069	3.44	0.040
27	*Leontopodium stracheyi*	30	1.5	0.022	3.37	0.050
28	*Moschela esculenta*	50	4.8	1.234	34.58	0.096
29	*Origanum bulgar*	20	0.9	0.056	3.17	0.045
30	*Plantago himalacia*	20	1.2	0.021	2.46	0.060
31	*Plantago lanceolata*	30	0.8	0.009	2.79	0.027
32	*Pleurospermum brunonis*	30	1.3	0.011	3.03	0.043
33	*Potentilla atrosanguinea*	20	1.2	0.008	2.16	0.060
34	*Potentilla neplensis*	30	0.8	0.076	4.36	0.027
35	*Prunela vulgaris*	20	0.9	0.022	2.38	0.045
36	*Ranuniculus arvensis*	30	0.6	0.012	2.78	0.020
37	*Ranuniculus hirtellus*	20	0.8	0.015	2.17	0.040
38	*Ranuniculus laetus*	20	0.6	0.018	2.16	0.030
39	*Saussurea lappa*	40	1.3	0.020	3.99	0.0325
40	*Selinium vaginatum*	20	1.1	0.006	2.07	0.055
41	*Thymus hexandrum*	20	1.4	0.100	4.39	0.070
42	*Thymus serphyllum*	30	1.2	0.011	2.99	0.040
43	*Thymus vulgarus*	20	0.8	0.009	2.03	0.040
44	Urginia indica	20	1.1	0.021	2.42	0.055

Table 3: Continue...

S r . No.	Species	Frequency (%)	Density (plants m^{-2})	Basal area (cm^2)	IVI	A/F ratio
45	*Valeriana jatamansi*	60	5.8	0.212	11.77	0.097
46	*Verbascum Thapsus*	20	1.3	0.433	12.16	0.065
47	*Vincetoxicum hirundinaria*	30	0.9	0.012	2.90	0.030
48	*Viola serpens*	70	85.5	0.008	78.77	1.220
	Total		153	4.267		

($0.002\ cm^2$). *Viola serpens* was the dominant species with highest value of IVI (78.77) followed by *Morchella esculenta* (34.58) as the codominant and *Artica parviflora* the associated species with IVI value of 1.49. At Kut, the distribution pattern of most species was reported random followed by contagious and least species were distributed contagiously.

Frequency, density, basal area and importance value index at Dal, are shown in Table 4. *Poa alpina* was found to have highest frequency (90%) closely followed by *Jurinea dolomiaea* (80%). *Poa alpina* was found to have highest density (60.6 plants m^{-2}) followed by *Poa annua* (35.5 plants m^{-2}) whereas, *Saussurea taraxacifolia* has the lowest density (0.6 plants m^{-2}). *Jurinea dolomiaea* has the highest basal area ($0.485\ cm^2$) followed by *Rheum moorcroftiasana* ($0.366\ cm^2$) whereas, *Poa alpina* has the lowest basal area ($0.004\ cm^2$). *Poa alpina* has the highest value of IVI (65.91) followed by *Poa annua* (42.14) whereas, *Buplerium falcatum* has the lowest value

Table 4: Frequency, density, basal area and importance value index at Dal

Sr. No.	Species	Frequency (%)	Density (plants m^{-2})	Basal area (cm^2)	IVI	A/F ratio
1	*Aconitum heterophyllum*	20	1.1	0.020	3.50	0.055
2	*Anaphalis basua*	30	1.6	0.015	4.67	0.053
3	*Anaphalis triplinervis*	20	0.8	0.110	6.77	0.040
4	*Anaphalis contorta*	30	1.3	0.103	7.87	0.043
5	*Angelica gulaca*	20	1.3	0.054	4.81	0.065
6	*Biebersteinia odora*	10	0.5	0.065	3.78	0.051
7	*Buplerium falcatum*	20	0.7	0.006	2.87	0.035
8	*Buplerium logicaule*	20	0.8	0.010	3.04	0.040
9	*Chrysopogon gryllus*	30	3.8	0.008	4.97	0.127
10	*Corydalis flabellate*	40	2.6	0.032	6.79	0.065
11	*Cynodon dactylon*	50	8.9	0.007	8.70	0.178
12	*Geranium rotundifolium*	30	1.8	0.014	4.68	0.060
13	*Geranium wallichiana*	40	2.8	0.020	6.40	0.070
14	*Gerbera gossypina*	20	0.9	0.011	3.11	0.045
15	*Juniperus cuminus*	20	1.6	0.322	14.88	0.080
16	*Jurinea dolomiaea*	80	4.8	0.485	29.18	0.060
17	*Leontopodium stracheyi*	20	0.9	0.023	3.56	0.045
18	*Plantago lanceolata*	30	1.1	0.012	4.43	0.037
19	*Pleurospermum candollei*	30	1.2	0.010	4.38	0.040
20	*Poa alpina*	90	60.6	0.004	65.91	0.067
21	*Poa annua*	60	35.5	0.006	42.14	0.592
22	*Rheum moorcroftiasana*	20	0.8	0.366	16.31	0.040
23	*Rhodiola imbricate*	20	0.7	0.342	15.39	0.035
24	*Saussurea albescens*	20	0.7	0.065	5.07	0.035
25	*Saussurea taraxacifolia*	20	0.6	0.231	11.23	0.030
26	*Urtica parviflora*	20	1.2	0.342	15.56	0.060
	Total		138.6	2.683		

of IVI (2.87). This depicts that *Poa alpina* was the dominant species, *Poa annua* codominant and *Buplerium falcatum* the associated species. At Dal, contagious distribution pattern of species was dominant followed by random pattern of distribution and none of the species was reported for regular distribution pattern.

Frequency, density, basal area and importance value index at Lahaud Dhar, are shown in Table 5. *Jurinea dolomiaea* was found to have highest frequency (70%) followed by *Gentiana kurrooa* (50%) whereas, *Podophyllum hexandrum* has the lowest frequency (10%). *Gentiana kurrooa* has the highest density (35.8 plants m^{-2}) followed by *Jurinea dolomiaea* (26.6 plants m^{-2}) whereas, *Euphorbia cognate* has the lowest density (0.5 plants m^{-2}). *Saussurea gossypiphora* has the highest basal area (0.542 cm^2) closely followed by *Jurinea dolomiaea* (0.541 cm^2). *Gentiana kurrooa* has the highest value of IVI (65.37) closely followed by *Jurinea dolomiaea* (65.36) whereas, *Pleurospermum brunonis* has the lowest value of IVI (5.54). It depicts that *Gentiana kurrooa* was the dominant species, *Jurinea dolomiaea* codominant and *Pleurospermum brunonis* the associated species. At Lahaud Dhar, the most of the species were distributed randomly followed by contagious pattern of distribution and the least species were reported for regular distribution pattern.

Table 5: Frequency, density, basal area and importance value index at Lahaud Dhar

Sr. No.	*Species*	Frequency (%)	Density (plants m^{-2})	Basal area (cm^2)	IVI	A/F ratio
1	*Aconitum heterophyllum*	20	0.9	0.032	6.58	0.045
2	*Angelica glauca*	30	1.7	0.041	9.89	0.057
3	*Cynodon dactylon*	30	2.8	0.008	9.52	0.093
4	*Euphorbia cognate*	20	0.5	0.023	5.79	0.025
5	*Gentiana kurrooa*	50	35.8	0.432	65.37	0.716
6	*Hypericum perphoratum*	30	1.2	0.012	8.11	0.040
7	*Jurinea dolomiaea*	70	26.6	0.541	65.36	0.380
8	*Onychium contigiuum*	20	0.8	0.044	7.01	0.040
9	*Pedicularis carnosa*	20	0.7	0.031	6.33	0.035
10	*Picrorhiza kurrooa*	30	1.5	0.028	9.15	0.050
11	*Pleurospermum brunonis*	20	0.8	0.011	5.54	0.040
12	*Poa alpina*	30	13.2	0.007	19.77	0.440
13	*Poa annua*	20	12.3	0.005	16.67	0.615
14	*Podophyllum hexandrum*	10	0.2	0.076	5.71	0.020
15	*Rheum moorcroftiasana*	20	0.8	0.089	9.02	0.040
16	*Saussurea gossypiphora*	20	0.6	0.542	29.01	0.030
17	*Saussurea taraxifolia*	30	0.5	0.320	21.17	0.017
	Total		100.9	2.242		

4. Conclusion

Maximum species (60) were reported from Deol area and minimum (17) from Lahaud Dhar. It has been observed that *Poa alpina* has the highest frequency (90%), highest density (60.6 plants m^{-2}) at Dal. *Gentiana kurrooa* has the highest density (35.8 plants m^{-2}) at Lahaud Dhar. *Moschela esculenta* has the highest basal area (1.234 cm^2) at Kut. *Viola serpens* was the dominant species with highest value of IVI (78.77) closely followed by *Poa alpine* (65.91), *Gentiana kurrooa* (65.37) and *Jurinea dolomiaea* (65.36). Most of the species were distributed randomly followed by contagious pattern of distribution and least number of species were reported showing regular distribution pattern.

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