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Floristic diversity of Lower and subalpine grazing meadows of Doodhganga Range, Pirpanchal Forest Division of Kashmir valley

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Abstract
The objective of this study was to study phytosociological status of selected open meadows along altitudinal gradient during 2020-21 of Doodhganga range, Pirpanchal forest division Budgam. A total of 80 herb species belonging to 30 families and 66 genuses were identified in the study area. The maximum average density of (plants/m²) was recorded of *Cyodon dactylon* pers.at all three altitudes, fallowed by *Sibaldeae cuneata* Edgew, *Trifolium repens* L. *Fragaria nibicola* Lindl etc. Highest frequency was achieved by *Cynodon dactylon* pers. fallowed by by, *Trifolium* spp. *Sibaldeae cuneata* Edgew, and Poa spp. Abundance to frequency ratio of most of species was between greater than 0.05 indicating Contagious distribution. The IVI indicates that *Cyodon dactylon* pers. was found most dominant species at all three altitudes (A1, A2, A3) with IVI value of (28.89,29.90,29.38) respectively fallowed by *Sibaldeae cuneata* Edgew. at A3(2800-3100 m) and *Fragaria nubicola* Lindl at A2(2500-2800 m) altitude. Shanon Weiner Index shows decreasing trend as altitude increases, was found maximum at lower altitude (2200-2500 m) with value of 1.68 and minimum at (2800-3100 m) with a value of 1.54. Simpsons index of Dominance was found higher at altitude (2800-3100 m) and decreases towards lower altitudes. Maximum similarity index was found between A2 and A3 altitudes and maximum dissimilarity was found between A1 and A3 altitudes.

Keywords: Phytosociological, herbs, meadows, Doodhganga Range, Pirpanchal Forest forest division, Kashmir valley

Introduction
The valley of Kashmir is gifted with vast stretch lush green of forests also called green gold. J&K is located in North-Western extremity of India between 32°17´ and 38°58´ North latitude and 73°35´ and 80°36´ East longitude with an average altitude of 1,586 meters from MSL and annual precipitation of about 794.7 mm. (Anonymous, 2014) [1]. Geographical area of J&K is 2,22,236 sq.km. constituting 6.67% 0f total area of country. As for as forest area is concerned, J&k has 20,230 sq. kms of forest area. Forests play an important role in economy of country, restore ecological balance of all ecosystems, maintain biological diversity, act as catchments for soil and water conservation and prevents floods also.

Phytosociology is quantitative study of vegetation It is study of plant component communities, its component structure and classifying the forms of vegetation. A key component of these biodiversity studies is the Phytosociological analysis, with the aid of sampling techniques; the organization and structure of communities can be studied and expressed quantitatively both in absolute terms of species with respect to all other plant species of the area. Field of Phytosociology studies species diversity which determines the distribution of individuals among the species in a particular habitat. Phytosociological inventories helps in identification of economically useful species as well as species of special concern, i.e. rare, uncommon and vulnerable species, and thus to quantify conservation worthiness of the candidate sites (Keel *et al.*, 1993) [11]. Phytosociology attempts also help in estimation of parameters like frequency, abundance, vegetation cover etc. These surveys are important tools for ecologists to evaluate & assess the vegetation types of given ecosystem. The quantitative information about each individual tree species is essential to understand their ecology and establish conservation management policies for them under pressure forests (Kharkwal, 2009) [13].

Materials and Methods

Site location

The present investigation entitled "Floristic diversity of Lower and subalpine grazing meadows of Doodhganga Range, Pirpanchal Forest Division 0f Kashmir valley" was conducted in Budgam district in Jammu and Kashmir India during 2020-21.

The Pirpanchal Forest Division is situated between 33° 42 ′ and 33° 58′ North Latitude and 74° 48′ and 74° 24′ East Longitude occupying an area of about 480.75 Sq. Kms. Pirpanchal forest division is separated by Zumkhul Nallah in S-E and Behak Nallah seperates it from recently carved special carved special Forest Division Tangmarg (Anonymous). The present study was carried out in Doodhganga forest range of Pirpanchal Forest Division, district Budgam Jammu and Kashmir. This region is a hilly terrain. Doodhganga Range is present in the Pirpanjal Forest Division. The geolocation of the study area is 33° 52' and 33° 40 North Latitude and 74° 30' and 74° 43' East Longitude. The elevation ranges from 1500m to 4800m. (Farooq M, Rashid H 2010) [9]. The area is rich in terms of floral diversity and possesses some unique kind of flora due to sloping terrain..The climate of the area is temperate, where summers are a bit hot withan average temperature of 31 °C and winters are very cold with an average temperature of -6 °C. The area receives annual mean rainfall of 500 mm to 1200 and mean annual snowfall of 200 to 600 cm. It experiences low rainfall but a very heavy snowfall during winter during which the temperature drops below freezing and remains frozen till the onset of spring season. The evergreen vegetation of forest mainly consists of Pinus walichiana, Abies pindrow and Cedrus deodara (Mir *et al*. 2021) [16].

Floristic composition of lower and subalpine meadows/Behaks and other phytosociological characteristics of the vegetation were studied through field surveys at three altitudinal sites along altitudinal gradient. The vegetation analysis was carried out by Multistage sampling design. Quadrats of 1m×1m and was laid at all the sites.

Layout of sampling plot

The present study on floristic composition was carried out in the sample plots/transects laid out in of different compartments of Doodhganga range along altitudinal gradient. The blank pasture/meadow areas of the Doodhganga range were divided into three altitudes and each altitude was divided into three sites. Multistage Sampling was carried out in the given area with 1.38% sampling intensity. In all the 18 sampling plots, of size 100m× 40m (4000 m²) size was laid on all the three sites/altitudes.

Number of altitudes	03
Number of sites per altitude	03
Number of transects per site	03
Number of Quadrats per transect	05
Number of Quadrats per site	15
Size of Quadrat	1m× 1m
No of Quadrats per altitude	45
Total no. of Quadrats	135

Floristic composition

Species presence or absence was recorded for each sampling season at selected sites (Curtis and McIntosh, 1950) [8].

Importance Value Index (IVI)

IVI determines the overall importance of each species in the community structure. and is worked out by using formula given by Misra (1968) [15]. Herbaceous species phytosociological characters were evaluated by analyzing the frequency, density, abundance and importance value index (IVI) using a formula recommended by Curtis and McIntosh (1950) [8].

Diversity and Dominance indices

a) Diversity: Shannon Weiner Index is a measure of the amount of information needed to describe every member of the community. Diversity of species is measured by Shanon Weaver Index (Shannon and Wiener, 1963) [17]. Shannon diversity index is calculated by formula:

$$H' = -\Sigma\, pi \ln pi$$

Where,
H′ = Shannon index of diversity, *p*i = the proportion ni and N i.e, *p*i = *n*i/N
*n*i = Total number of individuals of one species
N = Total number of individuals of all species

b) Simpson (1949) Index of Dominance

Simpson index of dominance gives probability that individuals, selected at random belonged to the same species. It is to calculated by Simpson's index, $D = \Sigma\, (pi)2$.

Where,
D = Simpson index of dominance, *p*i = the proportion ni and N i.e, *p*i = *n*i/N, *n*i = Total number of individuals of one species, N = Total number of individuals of all species.
As D increases, diversity decreases and Simpson's index will therefore usually be expressed as 1–D or 1/D.

c) Similarity index: Similarity Index is used to compare vegetation communities of various sites. Indices of similarity and dissimilarity were calculated by using Sorensen (1948) [20] formula which was as follows: Index of similarity (S) = 2C/A+B Where, S = Similarity, A= number of species in the community A, B= number of species in the community B, C = number of common species in both the communities. While index of dissimilarity was calculated as: Index of dissimilarity = 1-S

Results and Discussion

Table 1-4 shows the phytosociological characters like Density, Frequency, Abundance, IVI, Shanon Weiner Index of Diversity, Simpsons Index of Dominance for Rangelands/Behaks of Doodhganga Range of Pirpanchal Forest Division. Vegetation composition is a measure of species diversity in community. Consequently, it helps in identifying systematic types. Although it is a long term process to give conclusive information of vegetation composition in an area as it is expected to change with season. Effects of biotic as well as abiotic variables in a community and their interactions influence the vegetations (Whittaker, 1970). A total of 80 herb species belonging to 30 families were identified in the study area. Out of total families recorded Poaceae was dominant represented by 11 species fallowed by Asteraceae and Rosaceae equally by 10 species each. Renuculacea, Lamiaceae and plantiginaceae by 5 each, Polygonaceae and fabaceae by 4 each, Boraginaceae by 3, Labiateae and Malvaceae by 2 each and rest families by one each

Change in floristic composition along altitudinal gradient

The analysis of data of different altitudes shown in Table 1-2 revealed presence of 68 species in lower altitude sites (2200-2500 m), 56 species in (2500-2800 m) altitude & 51 species in (2800-3100 m) altitude. Highest density, Frequency, abundance and impotant value index was recorded for *Cynodon dactylon* pers at all three altitudes sites. *Cyanodon dactylon* is a valuable fodder grass that can be grazed (it withstands heavy grazing) or used in cut-and-carry systems. It is useful for hay, silage and pelletizing. It may be used for soil conservation (as a soil binder) and as lawn and turf grass (Ecocrop, 2012, Hanna, 1992) [10]. 12 species which were not found in 2500-2800 m altitude sites were found at lower altitudes, similarily 17 species which were not found in sub alpine zone were found at lower altitudes, indicating that as altitude increases biodiversity decreases. Sakia *et al*. (2017) studied the Eastern Himalayan forests, are very rich in terms of species diversity which decreases with increasing elevation. Species richness and distribution patterns of plants are largely regulated by altitude and other environmental factors. Intensive monitoring and management is needed to protect this fragile ecosystem from the ever-increasing anthropogenic pressure and changing climatic conditions. A opent grazed site, the number of plant species declined overtime, mainly the palatable species due to the selective grazing behaviour of animals, thereby decreasing the ratio of palatable to non-palatable species. Similar observations were also reported by other workers elsewhere (Vesk and Westoby, 2000; Sher *et al.*, 2005; Kukshal *et al.*, 2006; Baba *et al.*, 2017) [21, 14, 7].

Diversity and dominance indices of herbs

Data in Table-3 shows Diversity and dominance indices along altitudinal gradient. Shannon Weiner Diversity index was recorded maximum (1.68) at lower altitude (2200-2500 m) sites and shows general decrease as altitude increases, was recorded 1.54 at subalpine zone sites. Simpsons Index of Dominance was recorded maximum (0.97) at (2800-3100 m) and generally shows decrease towards lower altitudes. Diversity is generally believed to decrease with altitude and a similar trend was also found in the present study. Singh *et al*. (2018) [4] studied the phytosociology of Daksum grasslands of Anantnag forest division, Kashmir by dividing the whole area into three altitudes. IVI of herbaceous species indicated that cynodon dactylon was dominant at lower altitude while Sibaldeae cuneata and cynodon dactylon dominates the upper altitude site respectively. Devi *et al*. (2011) [5] Studies on the phytosociology and plant diversity of a grassland ecosystem at Thoubal (Thoubal district) Manipur, India. In this study 62 species were recorded (51 in Site-I and 56 in Site-II). The maximum IVI (Importance Value Index) was recorded for species like Axonopus compressus (54.04-89.61), Centella asiatica (38.85-68.97) and Arundinella nepalensis (11.74-40.65) respectively for both the study sites. The Shannon-Wiener Index values was ranging from 0.886 to 1.192. The Concentration of Dominance (Simpson Index) ranged from 0.086 to 0.275.Similar research phytosociological status of yousmarg Herbaceous Plant Community in Yusmarg Forest was conducted by Bhatti *et al*. (2014) [6] on three sites of different altitudes with marked differences in their physical and biotic features. 41 herb species belonging to 20 different families were observed. Highest IVI value of (93.81) was recorded for *Cynadon dactylon* at site 1 and lowest (1.54) for *Leucanthemum vulgar* and *Geum* sp. at site 1. Similarly Highest total relative density value of (52.46 was observed for *Cynodon dactylon* at site 1 and lowest (0.06) for *Leucanthemum vulgare* and *Geum* sp. at site 1. Shanon-Weaver diversity index shows small variation during the study period. Simpson's Dominance index was calculated to less than 1 which showed that the sites were not dominated by single species.

Similarity and Dissimilarity Indices of herbaceous species

Data shown in table-4 revealed that highest similarity index of 0.75 was recorded between altitudes of A2 (2500-2800 m) & A3 (2800-3100 m) similarly highest dissimilarity of 0.23 was recorded between altitude A1& A3. Bhatti *et al*. (2014) [6] studied the phytosociological status of Yousmarg Herbaceous Plant Community in Yousmarg Forest. The Sorenson's Similarity index was the highest (69.17%) between site 2 and site 3 and lowest (46.39%) between site 1 and site 3.

Table 1: Average Density m¯², Frequency, Abundance & A/F ratio of herbaceous species found at three main altitude open sites of Doodhganga Range

Name of species	Common name	Haigen((2200-2500m)				Doobkhal((2500-2800m)				Aayud(2800-3100m)			
		D	F	A	A/F	D	F	A	A/F	D	F	A	A/F
Agrimonia eupatoria L.	Common Agrimony					1.40	33.33	4.20	0.13				
Alchimelia trolli	Himalayan ladys mantle									6.4	53.33	12	0.23
Anemone biflora DC.	Wind Flowers	0.60	33.33	1.80	0.05								
Anemone obtusiloba D.Don	Himaliyan Thimbil weed					3.33	53.33	6.25	0.12	1.26	40.00	3.16	0.08
Arisaemia jacuemontii Blume.	Jacquemont'scobra-lily	0.57	46.66	1.29	0.03	0.66	26.66	2.50	0.09	0.46	26.66	1.75	0.07
Arctium lappa L.	Greator Burdock	0.26	26.66	1.0	0.04	0.66	40.00	1.66	0.04	0.13	20.00	0.66	0.03
Achillea millefolium L.	Common yarrow	3.60	33.33	7.80	0.23	1.00	20.00	5.00	0.25				
Adonis chrysocyathus Hook.	Yellow Himaliyan Oxeye Daisy									0.60	26.66	2.25	0.08
Anthemis cotula L.	Stinking chamomile	1.93	40	4.83	0.12	0.93	46.66	2.00	0.04	1.4	53.33	2.62	0.05
Artemisia absinthium L.	Worm weed	0.80	33.33	2.40	0.07	3	33.33	9.00	0.27	1.20	26.66	4.50	0.17
Adiantum cappilus veneris.	Maidenhair fern	0.66	33.33	2.00	0.06								
Ajuga Bracteosa Wall.	Bugleweed	0.53	26.66	2.00	0.07								
Bothriohloa ischaemum L.	Yellow Blue stone.	3.00	26.66	11.25	0.42								
Bistorta amplexicaule D.Don	Pashen Beda									3.53	60.00	5.88	0.11
Brommus inermis Leyss.	Arctic Broom	1.86	26.66	7.0	0.26	1.40	33.33	4.20	0.13				
Bergenia cilliata Sternb.	Hairy leaf Bergenia	0.66	33.33	2.0	0.06	0.53	20.00	2.66	0.13	1.66	33.33	5.00	0.15
Centuria iberica spreng.	Iberian starthistle	0.73	40	1.83	0.05								
Caltha Palustris Linn.	White marsh marigold	2.66	33.33	5.00	0.15	2.80	53.33	5.25	0.10	7.00	66.66	10..50	0.16
Cynodon dactylon pers.	Conch Grass	49.33	100	49.33	0.49	36.86	100	36.86	0.37	29.73	100	29.73	0.30

Cirsium spp.	Creeping thistle	6.53	73.33	8.91	0.12	0.26	20	1.33	0.07	0.53	20.00	2.67	0.13
Convolvulus arvensis L.	Bindweed	0.80	33.33	2.40	0.07								
Capsella bursa-pastoris L.	Shepherd's purse	7.46	73.33	10.18	0.14	5.20	66.66	7.80	0.12	0.87	26.66	3.25	0.12
Chenopodium album L.	Lamb's quarters	1.80	40.00	4.50	0.11	0.73	26.66	2.75	0.10	1.60	33.33	2.00	0.15
Coronella varia L.	Crown wetch	0.33	20.00	1.67	0.08	0.26	20.00	1.33	0.07				
Clinopodium vulgare L.	Wild basil	3.00	40.00	7.50	0.19					0.26	13.33	2.00	0.15
Canabis Sativa L.	Bang	1.20	26.66	4.50	0.17								
Cardus Palustris L.	Marsh Thistle	0.33	20.00	1.67	0.08								
Cynoglossum Wallichi G.Don	Berbed Forget me not					0.33	20.00	1.66	0.08				
Dactylis glomerata L.	Orchard grass	1.20	26.66	4.50	0.17	3.13	33.33	9.40	0.28	1.33	33.33	4.00	0.12
Daucus carota L.	Wild carrot	1.93	40.00	4.83	0.12	3.26	40.00	8.16	0.20	1.66	33.33	5.00	0.15
Datura stramonium	Jimsons weed	0.20	20.00	1.00	0.05	0.40	26.66	1.50	0.06	0.20	20.00	1.00	0.05
Digitalis lanata	Fox Glove					0.40	20.00	2.00	0.10				
Erigeron Canadensis L.	Daisy fleabane	0.20	13.33	1.50	0.11	0.73	20.00	2.00	0.18	0.33	13.33	2.50	0.19
Festuca arundinacea Schreb.	Tall fescue					2.00	26.66	7.50	0.28				
Festuca rubra L.	Red fescue	1.33	26.66	5.00	0.19								
Festuca gigantea Vill.	Giant fescue									0.86	26.66	3.25	0.12
Fragaria nubicola Lindl.	Himalayan strawberry	19.00	73.33	25.91	0.35								
Fragaria vesca Lindle.	Wild strawberry					23.40	100	23.40	0.23	5.93	73.33	8.09	0.11
Geum elatum wall.	Avens	4.46	40.00	11.17	0.28	10.33	80.00	12.91	0.16	10.93	60.00	18.22	0.30
Geranium pretense L.	Meadow Geranium	0.33	20.00	1.67	0.08	8.26	73.33	11.27	0.15	3.40	40.00	8.50	0.21
Iris ensata L.	Japanese Iris	1.46	40.00	3.67	0.09	0.53	33.33	1.60	0.05	1.46	46.66	3.14	0.07
Malva neglecta wall.	Common mallow	4.00	53.33	7.50	0.14	3.46	60.00	5.77	0.10				
Malva sylvestris Linn.		1.73	40.00	4.33	0.11	1.93	40.00	4.83	0.12	1.86	46.66	4.00	0.09
Matricaria chamomilla L.	May scented weed	5.73	73.33	7.82	0.11	0.40	26.66	1.50	0.06				
Medicago denticulate L.	Little Burr Clover	7.60	60.00	12.67	0.21	0.33	13.33	2.50	0.19				
Mentha longifolia Huds.	Wild Mint	4.33	60.00	7.22	0.12	2.13	46.66	4.57	0.10	0.66	26.66	2.50	0.09
Mentha spicata L.	Spear mint	3.86	46.66	8.29	0.18					0.46	20.00	2.33	0.12
Myosotis arvensis Hoffm.	Forget me not	1.00	33.33	3.00	0.09	0.80	33.33	2.40	0.07	0.20	13.33	1.5	0.11
Myosotis micrantha Pall.		0.80	26.66	3.00	0.11								
Nepata govanica Benth.	Catmint	5.13	40.00	12.83	0.32	0.53	26.66	2.00	0.08	0.46	20.00	2.33	0.03
Oxalis corniculata L.	Yellow Sorrel	1.33	13.33	10.00	0.75	0.60	26.66	2.00	0.08				
Partulacaceae olearaceae L.	Common Purslane	1.00	20.00	5.00	0.25	1.40	20.00	7.00	0.35	0.73	20.00	3.66	0.18
Pedicularis panctata Decn.	Indian warrior	1.40	26.66	5.25	0.20	1.60	33.33	4.80	0.14				
Persicaria hydropiper L.	Water Pepper	3.26	46.66	7.00	0.15	1.86	46.66	4.00	0.09	1.66	60.00	2.77	0.07
Prunela vulgaris L.	Self Heal	1.60	40.00	4.00	0.10	1.26	53.33	2.37	0.04	2.46	60.00	4.11	0.10
Potentilla nepalensis hook	Sinque foil	10.47	66.66	10.47	0.10					5.60	66.66	8.40	0.16
*Potentilla argyrophylla*Wall.	Sinque foil					1.80	53.33	3.37	0.06	1.73	26.66	6.50	0.13
Potentilla astrosanguinea Lodd.	Sinque foil	2.66	40.00	6.67	0.17								
Polygonum plebejium R,Br.	Common Knotweed	5.93	80.00	7.42	0.09								
Plantago major L.	Greator plantain	10.00	86.66	10.00	0.10	0.80	46.66	1.71	0.04	1.40	33.33	4.20	0.09
Plantago lanceolata L.	Narrow Leaved plantain	8.66	80.00	10.83	0.14	8.40	80.00	10.50	0.13	8.26	80.00	10.33	0.12
Poa annua L.	Annual meadow grass	10.13	40.00	25.33	0.63	2.33	53.33	4.37	0.08	1.86	20.00	9.33	0.62
Poa pretense L.	Smooth meadow grass	18.87	86.66	21.77	0.25	1.26	40.00	3.16	0.08				
Phytolacca acinosa Roxb.	Indian Pokeweed	0.20	13.33	1.50	0.11	0.13	13.33	1.00	0.08				
Ranunculus arvensis Linn.	Softly hairy butter cup	4.20	60.00	7.00	0.12								
Renunculus hirtellus Royle.	Softly hairy butter cup	1.80	40.00	4.50	0.11	1.13	26.66	4.25	0.16	0.40	20.00	2.00	0.11
Rumex nepalensis Spreng.	Common Sorrel	5.80	60.00	9.67	0.16	2.73	53.33	5.12	0.10	5.60	66.66	8.40	0.16
Rumex acetosa Linn.	Red sorrel	1.33	40.00	3.33	0.08					1.13	26.66	4.25	0.18
Sambucus wightiana Wall.	Kashmir elder	1.20	33.33	3.60	0.11	0.73	33.33	2.20	0.07	0.40	20.00	2.00	0.10
Stipa siberica L.	Needle grass	5.33	53.33	10.00	0.19	0.80	26.66	3.00	0.11	1.53	33.33	4.60	0.13
Sibaldeae cuneata Edgew.	Cuneate cinquefoil	10.27	53.33	19.25	0.36	32.86	86.66	37.92	0.44	26.20	86.66	30.23	0.21
Sorghum helepensis L.	Jhonson grass	1.20	26.66	4.50	0.17	1.53	26.66	5.75	0.22	1.40	33.33	4.20	0.13
Thymes linearis Benth.	Wild Thyme									2.73	33.33	8.20	0.25
Taraxacum officinale Weber.	Common dandlion	10.80	66.66	16.20	0.24	8.46	80.00	10.58	0.13	5.27	60.00	8.87	0.15
Trifolium pretense L.	Red clover	10.20	86.66	11.77	0.14	12.73	60.00	21.22	0.35	8.60	60.00	14.33	0.24
Trifolium repen L.	White clover	24.80	86.66	28.62	0.33	8.60	60.00	14.33	0.24	16.60	73.33	22.63	0.31
Urtica dioica L.	Stinging nettle	4.33	53.33	8.130.15		1.00	40.00	2.50	0.23	2.40	40.00	6.00	0.15
Verbascum Thapsus L.	Common mullein	0.33	20.00	1.67	0.08	0.46	20.00	2.33	0.06	0.93	26.66	3.50	0.13
Viola odorata L.	Bunafsha	0.20	13.33	1.50	0.11					0.33	13.33	2.50	0.19
Veronica Laxa L.	Germander speedwell	1.46	0.76	13.33	2.86	1.20	26.66	4.50	0.17	0.87	26.66	3.25	0.12

Table 2: Important value Index of herbaceous species at three altitudes of Doodhganga Range.

S. NO.	Name of species	Common name	(2200-2500 m)	(2500-2800) m	(2800-3100 m)
1.	*Agrimonia eupatoria* L.	Common Agrimony		3.08	
2.	*Alchimelia trolli*	Himalayan ladys mantle			13.21
3.	*Anemone biflora* DC.	Wind Flowers	1.66		
4.	*Anemone obtusiloba* D. Don	Himaliyan Thimbil weed		5.28	3.54
5.	*Arisaemia jacuemontii* Blume.	Jacquemont'scobra-lily	2.01	2.04	2.04
6.	*Arctium lappa* L.	Greator Burdock	1.17	2.36	2.32
7.	*Achillea millefolium* L.	Common yarrow	3.12	2.69	
8.	*Adonis chrysocyathus* Hook.	Yellow Himaliyan Oxeye Daisy			3.17
9.	*Anthemis cotula* L.	Stinking chamomile	2.90	2.84	3.47
10.	*Artemisia absinthium* L.	Worm weed		5.05	
11.	*Adiantum cappilus veneris.*	Maidenhair fern	1.84		3.28
12.	*Ajuga Bracteosa* Wall.	Bugleweed	1.72		
13.	*Bothriohloa ischaemum* L.	Yellow Blue stone.	1.45		
14.	*Bistorta amplexicaule D.Don*	Pashen Beda	4.04		5.92
15.	*Brommus inermis Leyss.*	Arctic Broom	2.85	3.08	
16.	*Bergenia cilliata Sternb.*	Hairy leaf Bergenia	1.72	1.75	4.00
17.	*Centuria iberica* spreng.	Iberian starthistle	1.93		
18.	*Caltha Palustris* Linn.	. White marsh marigold	5.04	4.79	9.53
19.	*Cynodon dactylon pers.*	Conch Grass	28.89	29.90	29.38
20.	*Cirsium spp.*	Creeping thistle	6.30	1.28	2.04
21.	*Convolvulus arvensis* L.	Bindweed	1.84		
22.	*Capsella bursa-pastoris* L.	Shepherd's purse	6.85	7.05	2.71
23.	*Chenopodium album* L.	Lamb's quarters	2.79	2.13	3.91
24.	*Coronella varia* L.	Crown wetch	1.10	1.28	
25.	*Clinopodium vulgare* L.	Wild basil	3.76		1.38
26.	*Canabis Sativa* L.	Bang	2.15		
27.	*Cardus Palustris* L.	Marsh Thistle	1.10		
28.	*Cynoglossum Wallichi* G.Don	Berbed Forget me not		1.40	
29.	*Dactylis glomerata* L.	Orchard grass	2.15	5.22	3.51
30.	*Daucus carota* L.	Wild carrot	2.90	5.22	3.51
31.	*Datura stramonium*	Jimsons weed	0.93	1.66	1.35
32.	*Digitalis lanata*	Fox Glove		1.52	
33.	*Erigeron Canadensis* L.	Daisy fleabane	0.80	2.10	1.57
34.	*Festuca arundinacea* Schreb.	Tall fescue		3.95	
35.	*Festuca rubra* L.	Red fescue	2.29		
36.	*Festuca gigantea* Vill.	Giant fescue			2.71
37.	*Fragaria nubicola* Lindl.	Himalayan strawberry	13.63		
38.	*Fragaria vesca* Lindle.	Wild strawberry		20.55	8.48
39.	*Geum elatum* wall.	Avens	4.94	27.90	13.37
40.	*Geranium pretense* L.	Meadow Geranium	1.10	9.59	3.22
41.	*Iris ensata* L.	Japanese Iris	2.52	2.01	3.39
42.	*Malva neglecta* wall.	Common mallow	4.53	5.49	4.44
43.	*Malva sylvestris* Linn.		2.74	3.75	
44.	*Matricaria chamomilla* L.	May scented weed	5.83	1.66	
45.	*Medicago denticulate* L.	Little Burr Clover	6.92	1.35	
46.	*Mentha longifolia* Huds.	Wild Mint	4.81	4.04	2.38
47.	*Mentha spicata* L.	Spear mint	4.42		1.90
48.	*Myosotis arvensis* Hoffm.	Forget me not	2.02	2.34	1.19
49.	*Myosotis micrantha* Pall.		1.73		
50.	*Nepata govanica* Benth.	Catmint	5.48	1.85	1.90
51.	*Oxalis corniculata* L.	Yellow Sorrel	2.81	1.87	
52.	*Partulacaceae olearaceae* L.	Common Purslane	1.96	3.28	2.45
53.	*Pedicularis panctata* Decn.	Indian warrior	2.36	3.23	
54.	*Persicaria hydropiper* L.	Water Pepper	3.98	3.77	4.58
55.	*Prunela vulgaris* L.	Self Heal	2.63	3.35	4.79
56.	*Potentilla nepalensis* hook	Sinque foil	8.77		
57.	*Potentilla argyrophylla*Wall.	Sinque foil		3.85	4.18
58.	*Potentilla astrosanguinea Lodd.*	Sinque foil	3.49		
59.	*Polygonum plebejium* R,Br.	Common Knotweed	6.04		
60.	*Plantago major* L.	Greator plantain	8.53	2.70	5.38
61.	*Plantago lanceolata* L.	Narrow Leaved plantain	7.59	10.24	10.74
62.	*Poa annua* L.	Annual meadow grass	9.51	4.35	4.39
63.	*Poa pretense* L.	Smooth meadow grass	13.23	3.02	
64.	*Phytolacca acinosa* Roxb.	Indian Pokeweed	0.80	1.19	
65.	*Ranunculus arvensis* Linn.	Softly hairy butter cup	4.73		
66.	*Renunculus hirtellus* Royle.	Softly hairy butter cup	2.79	2.71	1.76

67.	*Rumex nepalensis* Spreng.	Common Sorrel	5.76	4.72	8.11
68.	*Rumex acetosa* Linn.	Red sorrel	2.42		3.17
69.	*Sambucus wightiana* Wall.	Kashmir elder	2.20	2.26	1.76
70.	*Stipa siberica* L.	Needle grass	5.45	2.23	3.32
71.	*Sibaldeae cuneata* Edgew.	Cuneate cinquefoil	8.83	11.20	27.02
72.	*Sorghum helepensis* L.	Jhonson grass	2.15	3.28	3.61
73.	*Thymes linearis* Benth.	Wild Thyme			5.57
74.	*Taraxacum officinale* Weber.	Common dandlion	8.87	9.76	6.85
75.	*Trifolium pretense* L.	Red clover	8.49	13.64	18.83
76.	*Trifolium repen* L.	White clover	16.48	10.00	11.22
77.	*Urtica dioica* L.	Stinging nettle	4.76	2.73	5.03
78.	*Verbascum Thapsus* L.	Common mullein	1.10	1.63	2.83
79.	*Viola odorata* L.	Bunafsha	0.80		1.57
80.	*Veronica Laxa* L.	Germander speedwell	2.43	2.80	2.71
	Total		300	300	300

Table 3: Shannon wiener diversity index of diversity (H) & Simpsons Index of Dominance (D) of herb species along altitudinal gradient in Doodhganga range

Parameter	2200-2500 m	2500-2800 m	2800-3100 m
Shannon wiener diversity index of diversity (H)	1.68	1.57	1.54
Simpsons Index of Dominance (D)	0.97	0.91	0.86

Table 4: Similarity and Dissimilarity Index of herb species along altitudinal gradient of Doodhganga range

Similarity / Dissimilarity	2200-2500 m	2500-2800 m	2800-3100 m
2200-2500m	-	0.77	0.71
2500-2800m	0.23	-	0.75
2800-3100m	0.29	0.25	-

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