

# Floral diversity of District Bagh, Azad Jammu and Kashmir Pakistan

Muhammad Tanvir<sup>1</sup>, Ghulam Murtaza<sup>1</sup>, Khawaja Shafique Ahmad<sup>2,\*</sup>, Muhammad Salman<sup>3</sup>

<sup>1</sup>Department of Botany, University of Azad Jammu & Kashmir, Muzaffarabad

<sup>2</sup>Department of Botany, University of Agriculture, Faisalabad, Pakistan

<sup>3</sup>Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan

\*Corresponding author: khsahmad@yahoo.com

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**Abstract** The study showed the floral diversity and variation in the structure of vegetation in District Bagh, AJ&K. A total of 200 plants belong to 65 families and 170 genera were documented from seven localities. The most species richest site was found Mahmood Galli with 101 species (dicots 55, monocots 35, pteridophytes 10 and gymnosperm 1) followed by Toliper 100 spp. (dicots 55, monocots 31, pteridophytes 13 and gymnosperms 1), Lasdana, 85 spp. (dicots 47, monocots 35, pteridophytes 6 and gymnosperms 2), Plungi 81 spp. (dicots 51, monocots 13, pteridophytes 16 and gymnosperm 1), Khurshidabad, 74 spp. (dicots 34, monocots 21, pteridophytes 19), Kahutta, 70 spp. (dicots 36, monocots 15, pteridophytes 19) and Kiran 46 Spp. (dicots 34, gymnosperm 3). Among pteridophytes, *Polystichum squarrosus* had highest distribution percentage 85.71 % while *Lepisorus clathratus* and *Pyrrosia mollis* have least percentage distribution 4.28 %. Among gymnosperms, *Pinus wallichiana* had highest distribution percentage 57.14 % while *Cedrus deodara* and *Pinus roxburgii* have least distribution percentage 14.28. *Aristida abnormis* had highest distribution percentage with 71.42 % while *Zizania aquatica* and *Themeda anathera* have least distribution percentage with 14.28 %. In dicots, *Amaranthus viridis*, *Amaranthus spinosus* and *Cucumis sativus* had highest distribution percentage with 85.71 % and *Oxalis corniculata*, *Quercus incana* and *Fragaria nubicola* had least frequency with 14.28 %. Species diversity was high in the tree layer in the middle part of the altitudinal gradient. It decreases both towards upper and lower altitude, which was due to deforestation, human interaction, encroachment pressure, low number of species and soil erosion.

**Keywords** Floral Diversity, Distribution, District Bagh, AJ&K

communities are the spirit of vegetation science for centuries, [1]. Altitude, aspect and annoyance from human settlements have linear relationship with vegetation attributes such as species richness, diversity and maturity [2]. Topography is the principal controlling factor in vegetation growth and that the type of soils and the amount of rainfalls play secondary roles at the scale of hill slopes. Elevation, aspect, and slope are the three main topographic factors that control the distribution and patterns of vegetation in mountain areas [3]. Several studies acknowledge the relationship among plant species diversity, richness, climate and spatial variables in the area [4, 5]. The identification and description of local flora is very important, because it can show specific species of the local area and their occurrence, growing season, species hardness, distinct species, finding new species and the effect of climatic conditions like drought and over-grazing on vegetation [6].

An effective conservation plan cannot be implemented without knowing the status of indigenous plant species, ecology of habitat types, and factors affecting the population of plant species, particularly those of vulnerable and threatened either locally or internationally [7]. Knowledge on biodiversity of the study area is still fragmentary and requires deep studies to disclose all of its components. Flora of the Bagh region is currently under heavy pressure like anthropogenic activities, population pressure and grazing pressure. The objective of this study was to reveal the concealed anthropogenic and environmental factors disturbing the plant species diversity and richness. Present study will be helpful to ecologists, conservationists, forest managers and future researchers to compare any change in the species and species composition of plant communities of this hilly area.

## 1. Introduction

Composition, distribution and classification of plant

## 2. Materials and Methods

### 2.1. The Study Area

The state of Azad Jammu and Kashmir is located between

73°-75° longitude and 33°-36° latitude (figure 1). It is located in the Pirpanjal sub range of the western Himalayan foothills. The total area of District Bagh is 1368 square kilometres which is about 10% of total land area of Azad Jammu & Kashmir. Average annual temperature is 21°C, ranging from 2°C in January to 40°C in July. The annual precipitation is about 1500 mm [8].

## 2.2. Field Surveys

Extensive vegetation surveys of different ecological zones ranging from subtropical to alpine zones were conducted during 2009-10 to assess the floral diversity and community structure in the District Bagh. The area under research had great altitudinal variation exhibiting different zones such as subtropical, temperate and alpine. Seven different localities including Tauliper, Lasdana, Mahmood Gali, Khurshidabad, Plungi, Kahutta and Kiran were selected, considering altitudinal variations.

## 2.3. Vegetation Sampling

Quadrat method was used for vegetation sampling. A transect of 200 m length was used at each sampling site, where each sampling point was separated by 50 m from the next. Ten quadrats (10 m<sup>2</sup> for trees, 5 m<sup>2</sup> for shrubs and 1m<sup>2</sup> for herbs and grasses) were laid perpendicularly along a straight line at each sampling point, 5 on each side of the sampling point. Plant specimens were critically examined and identified with the help of literature and authentic specimens at the Department of Botany University of Azad Jammu and Kashmir. Flora of Pakistan [9, 10], was followed for the proper identification. The number of the plants scored with reference to its ecological amplitude, occurrence, distribution and relative frequency of plant species were listed in (Table 1). The collected specimens were deposited in herbarium Department of Botany University of Azad Jammu and Kashmir. The percentage distribution of plant species in different localities was determined by using following formula;

$$\text{Percentage Distribution} = \frac{\text{No of Localities in which a Plant Occurs}}{\text{Total No. of Localities}} \times 100$$

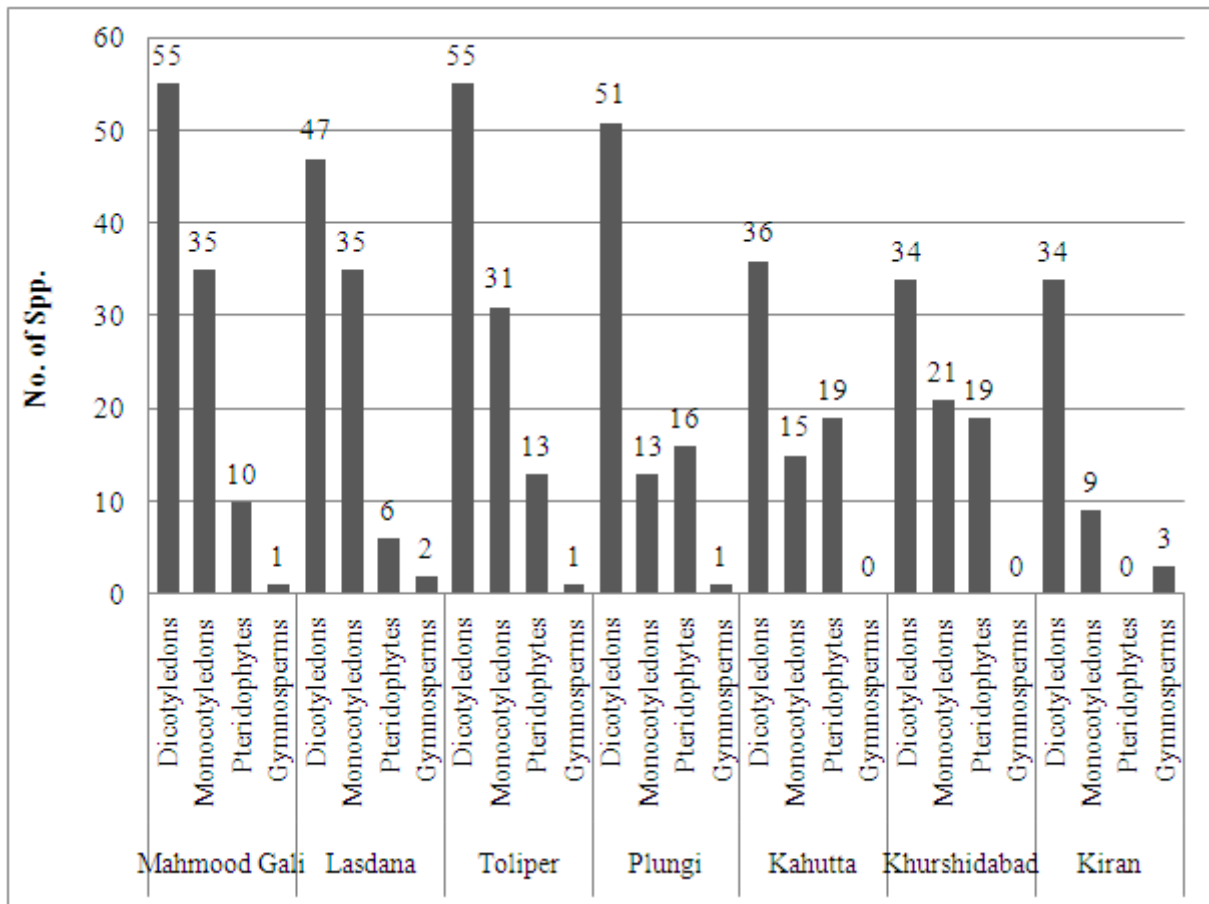


Figure 1. Plant groups distribution at 7 localities in the District Bagh, AJ&K.

**Table 1.** Occurrence and Percentage distribution of plants in Distric Bagh, AJ&K

S #	Plant groups	Family	Habit	Distribution							Distribution (%)	Relative frequency (%)
				L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	L <sub>4</sub>	L <sub>5</sub>	L <sub>6</sub>	L <sub>7</sub>		
	Pteridophytes											
1	<i>Lycopodium selago</i> L.	Lycopodiaceae	Herb	-	+	+	-	-	+	-	42.85	0.54
2	<i>Selaginella chrysocaulos</i> (Hook. & Grev.) Spring	Selaginellaceae	Herb	+	+	-	-	+	-	-	42.85	0.54
3	<i>S. sanguinolenta</i> (L.) Spring		Herb	-	-	-	+	-	+	-	28.57	0.36
4	<i>Equisetum arvense</i> L.	Equisetaceae	Herb	-	-	-	+	+	+	-	42.85	0.54
5	<i>E. diffusum</i> D.Don		Herb	-	-	-	+	+	+	-	42.85	0.54
6	<i>Ophioglossum reticulatum</i> L.	Ophioglossaceae	Herb	-	-	-	+	+	+	-	42.85	0.54
7	<i>O. vulgatum</i> L.		Herb	-	+	+	+	+	-	-	57.14	0.72
8	<i>Lygodium japonicum</i> (Thunb.) Sw.	Schizaceae	Herb	+	+	+	-	-	-	-	42.85	0.54
9	<i>Adiantum capillus- veneris</i> L.	Adiantaceae	Herb	-	-	-	-	+	+	-	28.57	0.36
10	<i>A. venustum</i> D.Don		Herb	-	-	-	+	+	-	-	28.57	0.36
11	<i>Coniogramme affinis</i> Wal (C.presl) Hieron		Herb	-	-	-	+	+	-	-	28.57	0.36
12	<i>C. caudata</i> (Wall.) Ching		Herb	-	-	-	+	+	-	-	28.57	0.36
13	<i>Onychium japonicum</i> (Thunb.) Kunze		Herb	-	-	+	+	+	-	-	42.85	0.54
14	<i>Pteridium aquilinum</i> (L.) Kuhn	Polypodiaceae	Herb	+	+	-	-	+	+	-	57.14	0.72
15	<i>P. vittata</i> L.	Pteridaceae	Herb	-	+	+	+	-	-	-	42.85	0.54
16	<i>Athyrium acrostichoides</i> Sw.		Herb	+	+	-	-	-	-	-	28.57	0.36
17	<i>A. dentigerum</i> (Wall. ex C.B. Clarke) Mehra		Herb	-	+	+	+	+	+	-	71.42	0.90
18	<i>A. schimperi</i> Moug. Ex Fee		Herb	-	-	+	+	+	+	-	57.14	0.72
19	<i>Dryopteris barbigera</i> (T.Moore ex Hook.) Kuntze	Dryopteridaceae	Herb	-	-	+	+	+	-	-	42.85	0.54
20	<i>Hypodematium crenatum</i> (Forssk.) Kuhn		Herb	-	-	-	+	-	+	-	28.57	0.36
21	<i>Polystichum discretum</i> (D.Don) J.Sm.		Herb	+	+	-	-	-	+	-	42.85	0.54
22	<i>P. squarrosum</i> (D.Don) Fee		Herb	+	+	+	+	+	+	-	85.71	1.08
23	<i>Asplenium pseudofontanum</i> Kossinsky	Aspleniaceae	Herb	-	-	+	+	+	+	-	57.14	0.72
24	<i>A. Trichomanes</i> L.		Herb	-	-	-	+	+	-	-	28.57	0.36

25	<i>A. dalhousiae</i> Hook.		Herb	-	-	+	-	-	+	-	28.57	0.36
26	<i>Lepisorus clathratus</i> (C.B. Clarke) Ching	Polypodiaceae	Herb	-	-	+	-	-	-	-	14.28	0.18
27	<i>L. nudus</i> (Hook.) Ching		Herb	-	-	-	+	+	+	-	42.85	0.54
28	<i>Pyrrosia mollis</i> (Kunze) Ching		Herb	-	-	+	-	-	-	-	14.28	0.18
29	<i>Marsilea minuta</i> L.	Marsiliaceae	Herb	-	-	-	+	+	+	-	42.85	0.54
Gymnosperms												
30	<i>Pinus roxburgii</i> Sarg.	Pinaceae	Tree	+	-	-	-	-	-	+	14.28	0.18
31	<i>Abies pindrow</i> (Royle ex D.Don) Royle		Tree	-	-	-	-	-	-	+	28.57	0.36
32	<i>Cedrus deodara</i> (Roxb. ex Lamb.) G. Don		Tree	-	-	-	-	-	-	+	14.28	0.18
33	<i>Pinus wallichiana</i> A. B. Jacks.		Tree	+	+	+	-	-	+	-	57.14	0.72
Monocotyledon												
34	<i>Arisaema jacquemontii</i> Blume	Araceae	Herb								57.14	0.72
35	<i>Iris germanica</i> L.	Iridaceae	Herb	+	+	+	-	-	-	+	28.57	0.36
36	<i>Aristida funiculata</i> Trin.	Poaceae	Herb	+	+	-	-	-	-	-	57.14	0.72
37	<i>A. abnormis</i> Chiov.		Herb	+	+	+	-	-	-	+	71.42	0.90
38	<i>Brachiaria ramosa</i> (L.) Stapf.		Herb	+	+	+	+	+	-	-	71.42	0.90
39	<i>B. deflexa</i> Schumach		Herb	+	+	+	+	+	-	-	28.57	0.36
40	<i>Calamagrostis decora</i> Hook.		Herb	+	+	-	-	-	-	-	71.42	0.90
41	<i>Danthonia cachemyriana</i> (Jaub) Spach		Herb	+	+	+	+	+	-	-	71.42	0.90
42	<i>D. schneideri</i> Pilger		Herb	+	+	+	+	+	-	-	28.57	0.36
43	<i>Glyceria tonglensis</i> (Clarke) L.		Herb	+	+	-	-	-	-	-	28.57	0.36
44	<i>G. plicata</i> (Fries) Fries.		Herb	+	+	-	-	-	-	-	71.42	0.90
45	<i>Melica persica</i> Kunth		Herb	+	+	+	+	+	-	-	57.14	0.72
46	<i>Microstegium nudum</i> Trin		Herb	+	+	+	-	-	-	+	71.42	0.90
47	<i>Phacelurus speciosus</i> Steud		Herb	+	+	+	+	+	-	-	28.57	0.36
48	<i>Phleum alpinum</i> L.		Herb	+	+	-	-	-	-	-	71.42	0.90
49	<i>Piptatherum hilariae</i> Pazij.		Herb	+	+	+	+	+	-	-	28.57	0.36

50	<i>P. gracile</i> Mez.	Herb	+	+	-	-	-	-	-	71.42	0.90
51	<i>Stipa capillata</i> L.	Herb	+	+	+	+	+	-	-	71.42	0.90
52	<i>S. breviflora</i> Griseb.	Herb	+	+	+	+	+	-	-	71.42	0.90
53	<i>Steria pumila</i> (Poir) Roem & Schult	Herb	+	+	+	+	+	-	-	28.57	0.36
54	<i>S. viridis</i>	Herb	+	+	-	-	-	-	-	28.57	0.36
55	<i>Cynodon dactylon</i> (L.) Pers.	Herb	+	+	-	-	-	-	-	42.85	0.54
56	<i>Dactylis glomerata</i> L.	Herb	-	-	+	+	-	+	-	28.57	0.36
57	<i>Chrysopogon serrulatus</i> Trin.	Herb	-	-	+	-	-	+	-	28.57	0.36
58	<i>C. aucheri</i> (Boiss.) Stapf	Herb	+	+	-	-	-	-	-	71.42	0.90
59	<i>Digitaria sanguinalis</i> (L.) Scop.	Herb	+	+	+	+	+	-	-	57.14	0.72
60	<i>Poa annua</i> L.	Herb	+	+	-	-	+	+	-	57.14	0.72
61	<i>P. neplensis</i> Wall. ex Duthie.	Herb	+	+	+	-	-	+	-	71.42	0.90
62	<i>Zizania aquatica</i> L.	Herb	+	+	+	+	+	-	-	14.28	0.18
63	<i>Dichanthium annulatum</i> (Forssk.) Staf	Herb	-	-	-	-	-	-	+	57.14	0.72
64	<i>Phalaris minor</i> Retz.	Herb	+	+	+	-	-	+	-	57.14	0.72
65	<i>Themeda anathera</i> (Nees ex Steud.)Hack.	Herb	+	+	+	+	-	+	-	14.28	0.18
66	<i>Avena sativa</i> L.	Herb	+	-	-	-	-	-	+	14.28	0.18
67	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.	Herb	-	-	-	-	-	-	+	57.14	0.72
68	<i>Andropogon gerardii</i> Vitman	Herb	+	+	+	-	-	+	-	14.28	0.18
69	<i>Heteropogon contortus</i> (L.) P. Beu. ex R. & Sch.	Herb	-	-	-	-	-	-	+	42.85	0.54
70	<i>Stipa orientalis</i> Trin.	Herb	-	-	+	+	-	+	-	28.57	0.36
71	<i>Panicum miliaceum</i> L.	Herb	+	+	-	-	-	-	-	42.85	0.54
72	<i>Agrostis viridis</i> Gouan	Herb	+	+	+	-	-	-	-	28.57	0.36
73	<i>A. hissarica</i> Rozhev.	Herb	+	+	-	-	-	-	-	42.85	0.54
74	<i>Alopecurus himalaicus</i> Hook	Herb	-	-	+	+	-	+	-	28.57	0.36
75	<i>A. aequalis</i> Sobol.	Herb	-	+	+	-	-	-	-	42.85	0.54
76	<i>Arundo donax</i> L.	Herb	-	-	+	+	-	+	-	42.85	0.54

77	<i>Briza media</i> L.		Herb	-	-	+	+	-	+	-	14.28	0.18
78	<i>Bromus inermis</i> Leyss.		Herb	-	-	-	-	-	-	+	42.85	0.54
79	<i>Carex brunnea</i> Thunb.	Cyperaceae	Herb	+	+	+	-	-	-	-	14.28	0.18
80	<i>C. buchananii</i> Berger.		Herb	-	-	-	-	-	-	+	57.14	0.72
81	<i>Cortaderia selloana</i> (Schult.) A. & Gr.		Herb	-	-	+	+	+	+	-	42.85	0.54
82	<i>Calamagrostis acutiflora</i> (Schrud.) DC.		Herb	-	-	+	+	-	+	-	14.28	0.18
Dicotyledons												
83	<i>Habenaria digitata</i> Lindl.	Orchidaceae	Herb	-	-	-	-	-	-	+	14.28	0.18
84	<i>Epipactis helleborine</i> (L.) Crantz		Herb								14.28	0.18
85	<i>Oenothera rosea</i> L Her. ex Aiton		Herb	-	-	-	-	-	-	+	14.28	0.18
86	<i>Zingiber capitatum</i> Roxb.	Zingiberaceae	Herb	-	-	-	-	-	-	+	14.28	0.18
87	<i>Amaranthus viridis</i> L.	Amaranthaceae	Herb	-	-	-	-	-	-	+	85.71	1.08
88	<i>A. spinosus</i> L.		Herb	-	-	-	-	-	-	+	85.71	1.08
89	<i>Achyranthes bidentata</i> Blume		Herb	+	+	+	+	+	+	-	28.57	0.36
90	<i>Mangifera indica</i> L.	Anacardiaceae	Herb	+	+	+	+	+	+	-	42.85	0.54
91	<i>Hedera nepalensis</i> K.Koch	Araliaceae	Tree	-	-	+	-	-	+	-	71.42	0.90
92	<i>Taraxacum officinale</i> Wabb	Asteraceae	Herb	+	+	-	-	-	+	-	42.85	0.54
93	<i>Artemisia vulgaris</i> L.		Herb	+	+	+	+	-	+	-	57.14	0.72
94	<i>Bidens bipinnata</i> L.		Herb	-	-	+	+	+	+	-	57.14	0.72
95	<i>Conyza canadensis</i> (L.) Cronquist		Herb	+	+	+	+	-	-	-	71.42	0.90
96	<i>Lactuca sativa</i> L.		Herb	+	+	+	-	-	+	-	28.57	0.36
97	<i>Helianthus annuus</i> L.		Herb	+	+	+	-	+	+	-	28.57	0.36
98	<i>Solidago virgaurea</i> L.		Herb	-	-	-	-	+	+	-	57.14	0.72
99	<i>Sonchus asper</i> (L.) Hill		Herb	-	-	-	-	+	-	+	57.14	0.72
100	<i>Anaphalis</i> spp.		Herb	+	+	+	-	+	-	-	14.28	0.18
101	<i>Lactuca dissecta</i> D.Don		Herb	-	-	+	+	+	+	-	28.57	0.36
102	<i>Achillea millefolium</i> L.		Herb	-	-	-	-	-	-	+	42.85	0.54

103	<i>Berberis lycium</i> Royle	Berberidaceae	Herb	-	-	-	+	-	-	+	57.14	0.72
104	<i>Trichodesma indicum</i> (L.) Lehm.	Boraginaceae	Shrub	+	+	+	-	-	-	-	28.57	0.36
105	<i>Cynoglossum lanceolatum</i> Forssk.		Herb	-	-	+	+	+	+	-	57.14	0.72
106	<i>Lepidium pinnatifidum</i> Ledeb.	Brassicaceae	Herb	+	+	-	-	-	-	-	57.14	0.72
107	<i>Buxus papillosa</i> C.K. Schneid.	Buxaceae	Herb	-	-	+	+	+	+	-	42.85	0.54
108	<i>Sarcococa pruniformis</i> Lindl.		Shrub	-	-	+	+	+	+	-	57.14	0.72
109	<i>Impatiens</i> spp.	Balsaminaceae	Shrub	-	-	-	+	+	+	-	14.28	0.18
110	<i>Commelina benghalensis</i> L.	Commelinaceae	Herb	+	+	+	-	-	+	-	28.57	0.36
111	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Herb	-	-	-	-	-	-	+	14.28	0.18
112	<i>Solena amplexicaulis</i> (Lam.) Gandhi	Cucurbitaceae	Herb	+	+	-	-	-	-	-	42.85	0.54
113	<i>Cucumis sativus</i> L.		Herb	-	-	-	-	-	-	+	85.71	1.08
114	<i>Lagenaria siceraria</i> (Molina) Standl.		Herb	+	+	-	-	+	-	-	28.57	0.36
115	<i>Momordica charantia</i> L.		Herb	+	+	+	+	+	+	-	28.57	0.36
116	<i>Convolvulus arvensis</i> L.	Convolvulaceae	Herb	-	+	+	-	-	-	-	28.57	0.36
117	<i>Ipomoea purpurea</i> (L.) Roth		Herb	+	+	-	-	-	-	-	28.57	0.36
118	<i>Campanula</i> spp	Campanulaceae	Herb	+	+	-	-	-	-	-	14.28	0.18
119	<i>Siene</i> spp.	Caryophyllaceae	Herb	-	-	+	+	-	-	-	14.28	0.18
120	<i>Chenopodium album</i> L.	Chenopodiaceae	Herb	-	-	-	-	-	-	+	42.85	0.54
121	<i>C. murale</i> L.		Herb	-	-	-	-	-	-	+	57.14	0.72
122	<i>Cannabis sativa</i> L.	Cannabinaceae	Herb	+	+	+	-	-	-	-	28.57	0.36
123	<i>Viburnum nervosum</i> D.Don	Caprifoliaceae	Herb	+	+	-	-	+	+	-	14.28	0.18
124	<i>V. grandiflorum</i> Wall. ex DC.		Shrub	+	+	-	-	-	-	-	42.85	0.54
125	<i>Prosopis sineraria</i> (L.) Druce	Cesaelpinlaceae	Shrub	-	-	-	-	-	-	+	14.28	0.18
126	<i>Euphorbia helioscopia</i> L.	Euphorbiaceae	Shrub	+	+	+	-	-	-	-	42.28	0.53
127	<i>Diospyros kaki</i> Thunb.	Ebenaceae	Herb	-	-	-	-	-	-	+	28.57	0.36
128	<i>D. lotus</i> L.		Tree	+	+	+	-	-	-	-	42.85	0.54
129	<i>Elaeagnus umbellata</i> Thunb.	Elaeagnaceae	Tree	+	-	+	-	-	-	-	14.28	0.18

130	<i>Quercus incana</i> Bartram	Fagaceae	Shrub	+	+	+	-	-	-	-	14.28	0.18
131	<i>Swertia paniculata</i> Wall.	Gentianaceae	Tree	-	-	-	-	-	-	+	14.28	0.18
132	<i>Geranium willichianum</i> D.Don ex Sweet	Geraniaceae	Herb	-	-	-	-	-	-	+	14.28	0.18
133	<i>Hypericum spp.</i>	Hypericaceae	Herb	-	-	-	-	-	-	+	14.28	0.18
134	<i>Juglans regia</i> L.	Juglandaceae	Herb	-	-	-	-	-	-	+	42.85	0.54
135	<i>Mentha piperita</i> L.	Labiataeae	Tree	-	-	-	-	-	-	+	28.57	0.36
136	<i>Stachys melissifolia</i> Benth.		Herb	+	+	+	-	-	-	-	42.85	0.54
137	<i>Origanum vulgare</i> L.		Herb	+	+	-	-	-	-	-	28.57	0.36
138	<i>Malva sylvestris</i> L.	Malvaceae	Herb	+	+	+	-	-	-	-	42.85	0.54
139	<i>Micromeria biflora</i> (Buch.-Ham ex D.Don) Benth.		Herb	-	+	+	-	-	-	-	42.85	0.54
140	<i>Ajuga integrifolia</i> Buch.-Ham.		Herb	+	+	+	-	-	-	-	14.28	0.18
141	<i>Abutilon indicum</i> (L.) Sweet		Herb	+	+	+	-	-	-	-	28.57	0.36
142	<i>Hibiscus esculantus</i> L.		Herb	-	-	-	-	-	-	+	42.85	0.54
143	<i>Acea rosea</i> L.		Herb	-	-	+	-	-	+	-	42.85	0.54
144	<i>Melia azadarach</i> L.	Meliaceae	Herb	-	-	-	+	+	+	-	28.57	0.36
145	<i>Acacia nilotica</i> Schumach & Thonn	Moraceae	Tree	-	-	-	+	+	+	-	28.57	0.36
146	<i>Ficus carica</i> L.		Tree	+	+	-	-	-	-	-	14.28	0.18
147	<i>F. palmata</i> Forssk.		Tree								42.85	0.54
148	<i>Morus alba</i> L.		Tree	-	-	-	-	-	-	-	28.57	0.36
149	<i>M. nigra</i> L.		Tree	+	+	+	-	-	-	+	57.14	0.72
150	<i>Broussonetia papyrifera</i> (L.) L Her. ex Vent.		Tree	-	-	+	+	-	+	-	14.28	0.18
151	<i>Eucalyptus citriodora</i> Hook.	Myrtaceae	Tree	+	+	+	-	-	+	-	42.85	0.54
152	<i>Jasminum grandiflorum</i> L.	Oleaceae	Tree	-	-	-	-	-	-	+	57.14	0.72
153	<i>J. officinale</i> L.		Shrub	-	-	+	+	-	+	-	57.14	0.72
154	<i>Oxalis corniculata</i> L.	Oxalidaceae	Shrub	-	+	+	-	+	+	-	14.28	0.18
155	<i>Polygonum bistorta</i> L.	Polygonaceae	Herb	-	-	+	+	+	+	-	57.14	0.72
156	<i>P. alpinum</i> All.		Herb	-	-	-	-	-	-	+	14.28	0.18



157	<i>Rumex dentatus</i> L.		Herb	+	+	+	-	-	+	-	57.14	0.72
158	<i>Rumex nepalensis</i> Spreng		Herb	-	-	-	-	-	-	+	14.28	0.18
159	<i>Persicaria nepalensis</i> (Meisn.) Miyabe		Herb	+	+	+	+	-	+	-	57.14	0.72
160	<i>Androsace rotundifolia</i> Hardw.	Primulaceae	Herb	+	+	-	-	-	-	+	14.28	0.18
161	<i>Medicago lupulina</i> L.	Papilionaceae	Herb	+	+	+	+	-	+	-	28.57	0.36
162	<i>Phaseolus lunatus</i> L.		Herb	-	-	-	-	-	-	+	57.14	0.72
163	<i>Robinia pseudoacacia</i> L.		Herb	-	-	-	+	+	-	-	57.14	0.72
164	<i>Indigofera heterantha</i> Brandis		Tree	+	+	+	-	-	+	-	14.28	0.18
165	<i>Lathyrus aphaca</i> L.		Shrub	-	-	+	+	+	+	-	42.85	0.54
166	<i>Trigonella foenum-graceum</i> L.		Herb	-	-	-	-	-	-	+	28.57	0.36
167	<i>Crotalaria medcaginea</i> Lam.		Herb	+	+	-	-	-	+	-	28.57	0.36
168	<i>Punica granatum</i> L.	Punicaceae	Shrub	-	-	-	+	-	+	-	42.85	0.54
169	<i>Plantago lanceolata</i> L.	Plantaginaceae	Tree	-	+	-	-	-	+	-	14.28	0.18
170	<i>Geum elatum</i> Wall. ex G.Don	Rosaceae	Herb	+	+	-	-	+	-	-	14.28	0.18
171	<i>Eriobotrya japonica</i> (Thunb.) Lindl.		Herb	-	-	-	-	-	-	+	28.57	0.36
172	<i>Fragaria nubicola</i> (Hook.f.) Lindl. Ex Lacaita		Tree	-	-	-	-	-	-	+	14.28	0.18
173	<i>Rosa indica</i>		Herb	-	+	-	-	+	-	-	42.85	0.54
174	<i>Potentilla nepalensis</i> Hook.f.		Shrub	-	-	-	-	-	-	+	42.85	0.54
175	<i>P. fruticosa</i> L.		Herb	-	-	-	+	+	+	-	57.14	0.72
176	<i>Duchesnea indica</i> (Andrews) Focke		Herb	-	-	+	+	-	+	-	14.28	0.18
177	<i>Malus pumila</i> Mill.		Herb	-	+	+	+	+	+	-	57.14	0.72
178	<i>Prunus persica</i> (L.) Stokes		Tree	-	-	-	-	-	-	+	57.14	0.72
179	<i>P. armeniaca</i> L.		Tree	-	-	+	+	+	+	-	57.14	0.72
180	<i>Pyrus pashia</i> Buch. –Ham. ex D.Don		Tree	+	+	+	-	-	+	-	57.14	0.72
181	<i>Prunus domestica</i> L.		Tree	+	+	+	-	-	+	-	42.85	0.54
182	<i>Prunus bokhariensis</i> Royle		Tree	+	-	+	+	-	+	-	57.14	0.72
183	<i>Malus sylvestris</i> Mill.		Tree	-	-	-	+	+	+	-	28.57	0.36

184	<i>Zanthoxylum allatum</i> Roxb.	Rutaceae	Tree	-	-	+	+	+	+	-	42.85	0.54
185	<i>Galium aparine</i> L.	Rubiaceae	Shrub	+	-	-	+	-	-	-	57.14	0.72
186	<i>G. Boreale</i> L.		Herb	-	+	+	-	+	-	-	42.85	0.54
187	<i>Glematic spp.</i>	Ranunculaceae	Herb	-	-	+	+	+	+	-	14.28	0.18
188	<i>Ranunculus muricatus</i> L.		Shrub	-	+	-	-	+	+	-	42.85	0.54
189	<i>Thalictrum foliolosum</i> DC.		Herb	-	-	-	-	-	-	+	57.14	0.72
190	<i>Solanum nigrum</i> L.	Solanaceae	Herb	+	+	+	-	-	-	-	42.85	0.54
191	<i>S. tuberosum</i> L.		Herb	-	+	+	-	+	+	-	42.85	0.54
192	<i>Lycopersicum esculentum</i> Mill.		Herb	-	-	-	+	+	+	-	42.85	0.54
193	<i>Cestrum nocturnum</i> L.		Herb	-	-	+	-	+	+	-	57.14	0.72
194	<i>Verbascum thapsus</i> L.	Scrophylariaceae	Shrub	+	+	-	-	-	+	-	57.14	0.72
195	<i>Populus nigra</i> L.	Salicaceae	Herb	+	+	-	-	+	+	-	42.85	0.54
196	<i>P. alba</i> L.		Tree	+	+	+	+	-	-	-	28.57	0.36
197	<i>Anethum graveolens</i> L.	Simaroubaceae	Tree	-	+	+	-	+	-	-	57.14	0.72
198	<i>Urtica dioica</i> L.	Urticaceae	Herb	-	-	-	-	-	-	+	42.85	0.54
199	<i>Viola odorata</i> L.	Violaceae	Shrub	-	+	-	-	-	+	-	42.85	0.54
200	<i>Vitis vinifera</i> L.	Vitaceae	Herb	+	+	-	-	-	-	-	42.85	0.54

Index: L<sub>1</sub>= Lasdana, L<sub>2</sub> = Mahmood Gali, L<sub>3</sub>= Toliper L<sub>4</sub>= Khurshidabad, L<sub>5</sub>= Kahutta, L<sub>6</sub>= Hajiper, L<sub>7</sub>= Kiran, + = Present, -=Absent

### 3. Results and Discussion

#### 3.1. Floristic Composition

During the study, the whole flora was explored from subtropical foothills of Kahutta to alpine pasture of Kiran. A total of 200 plant species of 170 genera and 65 families were reported from study area. The study area was divided into seven subunits (Figure 1), based on altitudinal variations. Richest site was Mahmood Gali with 101 species (dicots 55, monocots 35, pteridophytes 10 and gymnosperm 1) followed by Toliper 100 spp. (dicots 55, monocots 31, pteridophytes 13 and gymnosperms 1), Lasdana, 85 spp. (dicots 47,

monocots 35, pteridophytes 6 and gymnosperms 2), Plungi 81spp. (dicots 51, monocots13, pteridophytes 16 and gymnosperm 1), Khurshidabad, 74 spp. (dicots 34, monocots 21, pteridophytes 19), Kahutta, 70 spp. (dicots 36, monocots 15, pteridophytes 19 ) and Kiran 46 Spp. dicots 34, gymnosperm 3).

The checklist comprised of 167 angiosperms, (dicots 118 and monocots 49), 29 pteridophytes and 4 gymnosperms (Figure 3). Dominating life forms in all seven sites were herbs (156 spp.), followed by shrubs (29 spp.) and trees (15 spp., Figure 2). The leading family was Poaceae with 42 species (Figure 4) followed by Rosaceae and Asteraceae (14, 11 spp.), other families were with fewer number of species.

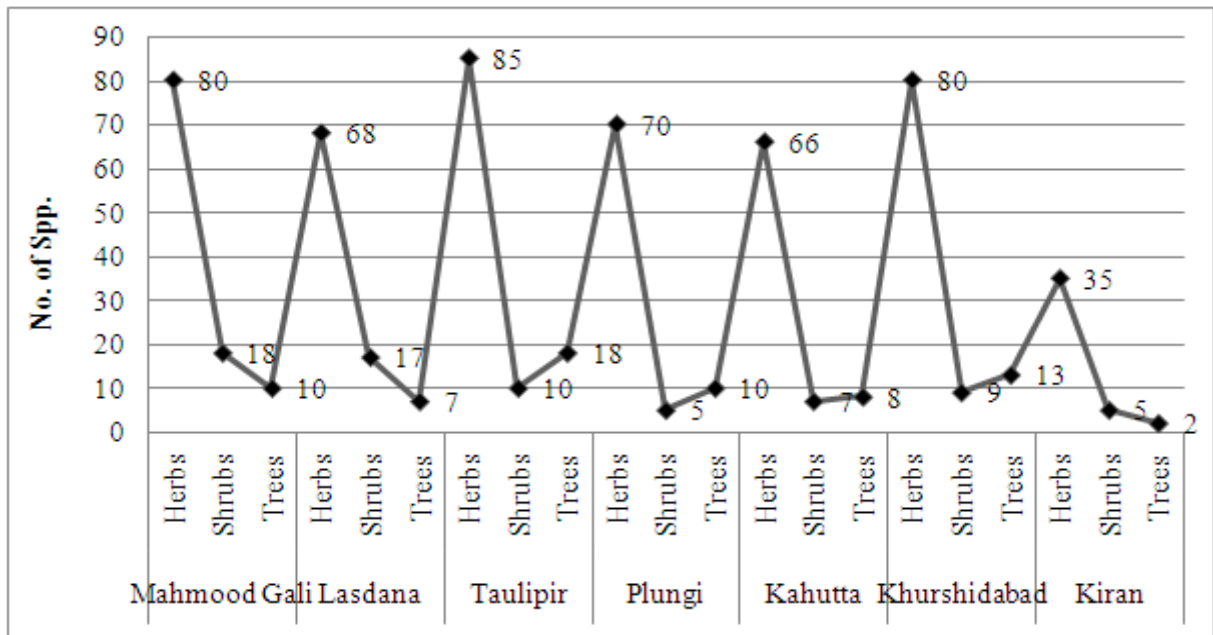


Figure 2. Life forms of various localities in the District Bagh, AJ&K.

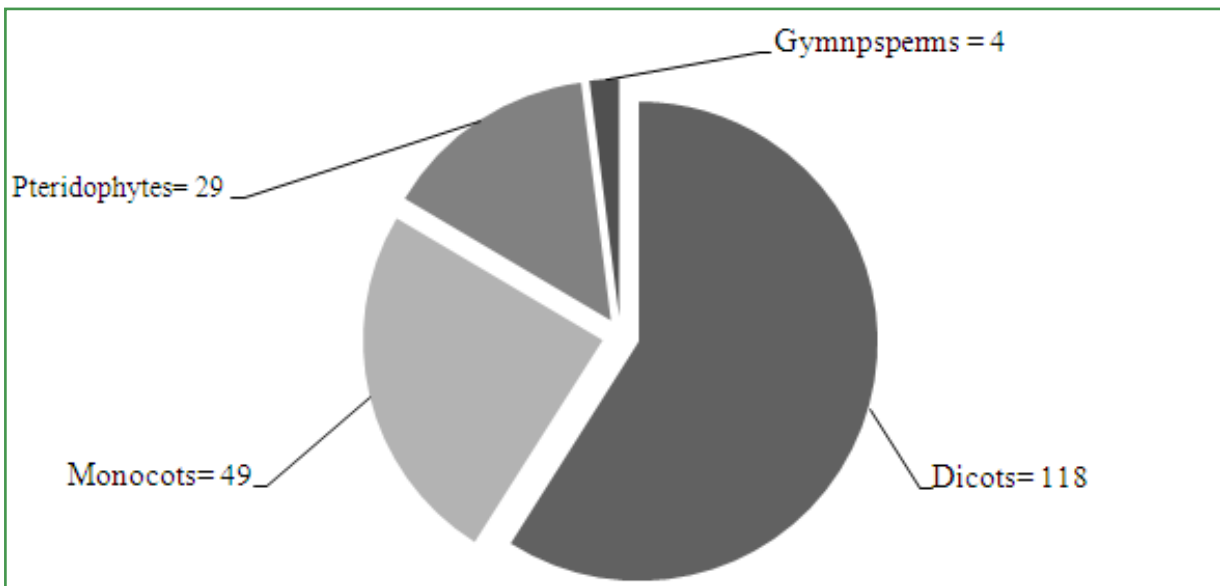


Figure 3. Plant groups of the District Bagh, AJ&K.

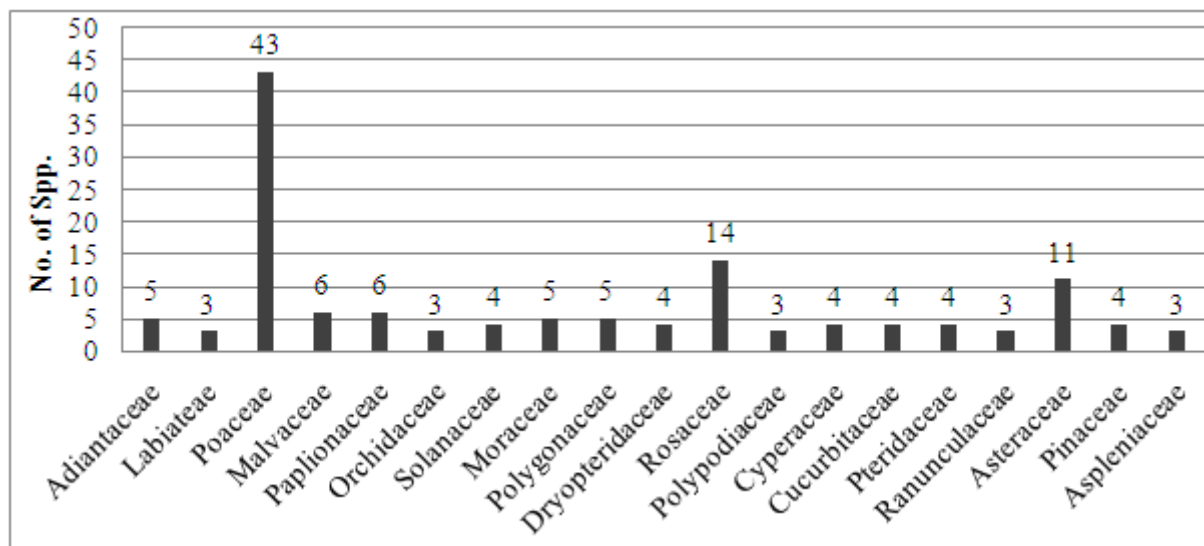


Figure 4. Dominating families of the District Bagh, AJ&K.

### 3.2. Percentage Distribution

Among peridophytes, *Polystichum squarrosum* had highest distribution percentage 85.71 % and high relative frequency 1.08% (Table 1), while *Lepisorus clathratus* and *Pyrrosia mollis* have least percentage distribution 4.28 % with low relative frequency 0.18%. All the reported species of gymnosperm were trees. *Pinus wallichiana* had highest distribution percentage 57.14 % and relative frequency 0.72% while *Cedrus deodara* and *Pinus roxburgii* have least distribution percentage 14.28 % and low relative frequency 0.18%. *Aristida abnormis* had highest distribution percentage with 71.42 % and relative frequency 0.92% while *Zizania aquatica* and *Themeda anathera* and *Briza media* have least distribution percentage with 14.28 % and low relative frequency 0.18%. In dicots, *Amaranthus viridis*, *Amaranthus spinosus* and *Cucumis sativus* had highest distribution percentage with 85.71 % and high relative frequency 1.08% while *Oxalis corniculata*, *Quercus incana* and *Fragaria nubicola* have least frequency with 14.28 %.

### 3.3. Altitudinal Variation

It was observed that percentage distribution (frequency) decreases with the increase in altitude while it was high in the low altitude. Similar findings were reported by [11]. The experiential decrease in species distribution is due to deforestation, human interaction, collections of medicinal plants and quick disappearance of annual plants because of cold conditions [12]. Species diversity was high in the tree layer in the middle part of the altitudinal gradient. It decreases both towards upper and lower altitude, which was due to deforestation, human interaction, encroachment pressure, low number of species and soil erosion.

### 3.4. Threatened Flora of Kashmir

Medicinal flora of Senhsa, District Kotli (adjacent area of

District Bagh) is under serious threats [1]. *Ajuga bracteosa*, *Mallotus philippinensis*, *Butea monosperma*, and *Zanthoxylum armatum* are critically endangered not only locally, but also in the whole region. Among endangered species, *Cissus carnosa*, *Juglans regia*, *Olea ferruginea*, *Phyllanthus emblica*, *Viola canescens* are the notable species, which are at high risk of being endangered [13]. An effective conservation plan cannot be implemented without knowing the indigenous flora, habitat ecology and anthropogenic factors, affecting the population of plant species, particularly those of vulnerable and threatened either locally or internationally [14]. In Neelum valley, *Saussurea lappa*, *Aconitum heterophyllum*, *Geranium wallichianum*, *Jurinea dolomiaea*, *Ajuga bracteosa*, *Bistorta amplexicaule*, and *Berberis lyceum* are on the verge of extinction due to high rate of utilization [15]. There has been a rapidly increasing interest in the effects of species richness on community productivity in recent years. The relationship between species diversity and ecosystem function, combined with the worldwide loss of species, has become one issue that has attracted substantial attention [16]. Decreasing primary productivity and changes in the structure of plant communities have been caused by the destruction of biodiversity, unreasonable exploitation and overgrazing of grassland resources in some areas, with consequent impacts on human society. Productivity is one of the important modalities by which to weigh up ecosystem functions [17], so a healthier knowledge of the association between plant-species diversity and ecosystem functioning would help to indulgent whole ecosystems.

## 4. Conclusion

The interest behind the selection of the area was its thick vegetation and great altitudinal variation, ranging from subtropical to alpine. The area lies in temperate zone,

characterized by cold climate. Plant resources are limited that require efficient, wise and sustainable management and conservation strategies. Necessary steps should be taken not only to store the original vegetation but also to improve it. Overgrazing and deforestation should be abridged. Forest management practices that benefit biodiversity conservation should be encouraged. Awareness programs at grass root level should be introduced.

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