Floral diversity of District Bagh, Azad Jammu and Kashmir Pakistan

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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 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). Among pteridophytes, Polystichum squarrosum had highest distribution percentage 85.71 % while Lepisorus clathratus and Pyrrrosia mollis have least percentage distribution 4.28 %. Among gymnosperms, Pinus wallichiana had highest distribution percentage 57.14 % while Cedrus deodara and Pinus roxburghii 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, Distric Bagh, AJ&K

1. Introduction

Composition, distribution and classification of plant 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.

2. Materials and Methods

2.1. The Study Area

The state of Azad Jammu and Kashmir is located between
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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 m² for trees, 5 m² for shrubs and 1m² 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;

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

![Percentage Distribution](image)

**Figure 1.** Plant groups distribution at 7 localities in the District Bagh, AJ&K.
| S # | Plant groups                                      | Family          | Habit | L1 | L2 | L3 | L4 | L5 | L6 | L7 | Distribution (%) | Relative frequency (%) |
|-----|--------------------------------------------------|-----------------|-------|----|----|----|----|----|----|----|------------------|--------------------------|
| 1   | *Lycopodium selago* L.                           | Lycopodiaceae   | Herb  | -  | +  | +  | -  | -  | -  | -  | 42.85            | 0.54                      |
| 2   | *Selaginella chrysocaulos* (Hook. & Grev.) Spring| Selaginellaceae  | Herb  | +  | +  | -  | -  | -  | +  | -  | 42.85            | 0.54                      |
| 3   | *S. sanguinolenta* (L.) Spring                   | Selaginellaceae  | Herb  | -  | -  | +  | +  | -  | -  | -  | 28.57            | 0.36                      |
| 4   | *Equisetum arvense* L.                           | Equisetaceae    | Herb  | -  | -  | -  | +  | +  | -  | -  | 42.85            | 0.54                      |
| 5   | *E. diffusum* D.Don                              |                 | Herb  | -  | -  | -  | -  | +  | +  | -  | 42.85            | 0.54                      |
| 6   | *Ophioglossum retculatum* L.                     | Ophioglossaceae | Herb  | -  | -  | -  | +  | +  | +  | -  | 42.85            | 0.54                      |
| 7   | *O. vulgatum* L.                                 |                 | Herb  | +  | +  | +  | +  | -  | -  | -  | 57.14            | 0.72                      |
| 8   | *Lygodium japonicum* (Thunb.) Sw.                | Schizaceae      | Herb  | +  | +  | +  | -  | -  | -  | -  | 42.85            | 0.54                      |
| 9   | *Adiantum capillus-veneris* L.                    | Adiantaceae     | Herb  | -  | -  | -  | -  | +  | +  | -  | 28.57            | 0.36                      |
| 10  | *A. venustum* D.Don                              |                 | Herb  | -  | -  | -  | +  | -  | -  | -  | 28.57            | 0.36                      |
| 11  | *Coniogramme affinis* Wal (C.presl) Hieron       |                 | Herb  | -  | -  | -  | +  | -  | -  | -  | 28.57            | 0.36                      |
| 12  | *C. caudata* (Wall.) Ching                       |                 | Herb  | -  | -  | -  | +  | -  | -  | -  | 28.57            | 0.36                      |
| 13  | *Onychium japonicum* (Thunb.) Kunze              |                 | Herb  | +  | +  | -  | -  | +  | -  | -  | 42.85            | 0.54                      |
| 14  | *Pteridium aquilinum* (L.) Kuhn                  | Polypodiaceae   | Herb  | +  | +  | -  | -  | +  | -  | -  | 57.14            | 0.72                      |
| 15  | *P. vittata* L.                                  | Pteridaceae     | Herb  | -  | +  | +  | +  | -  | -  | -  | 42.85            | 0.54                      |
| 16  | *Athyrium acrostichoides* Sw.                    |                 | Herb  | +  | +  | -  | -  | -  | -  | -  | 28.57            | 0.36                      |
| 17  | *A. dentigerum* (Wall. ex C.B. Clarke) Mehr     |                 | Herb  | +  | +  | -  | -  | +  | -  | -  | 71.42            | 0.90                      |
| 18  | *A. schimpert* Moug. Ex Fee                     |                 | Herb  | -  | +  | +  | -  | +  | -  | -  | 57.14            | 0.72                      |
| 19  | *Dryopteris barbigera* (T.Moore ex Hook.) Kuntze| Dryopteridaceae | Herb  | -  | +  | +  | +  | -  | -  | -  | 42.85            | 0.54                      |
| 20  | *Hypodematum crenatum* (Forssk.) Kuhn           |                 | Herb  | +  | -  | -  | -  | +  | -  | -  | 28.57            | 0.36                      |
| 21  | *Polystichum discreatum* (D.Don) J.Sm.          |                 | Herb  | +  | +  | -  | -  | +  | -  | -  | 42.85            | 0.54                      |
| 22  | *P. squarrosum* (D.Don) Fee                      |                 | Herb  | +  | +  | +  | +  | +  | -  | -  | 85.71            | 1.08                      |
| 23  | *Asplenium pseudofontanum* Kossinsky            | Aspleniaceae    | Herb  | -  | -  | +  | +  | +  | -  | -  | 57.14            | 0.72                      |
| 24  | *A. Trichomanes* L.                              |                 | Herb  | -  | -  | +  | +  | -  | -  | -  | 28.57            | 0.36                      |
|   | Common Name | Family       | Life Form | Symbols | Percent | CI  |
|---|-------------|--------------|-----------|---------|---------|-----|
|25 | A. dalhousiae Hook. | Herb | - - + - - + - | 28.57 | 0.36 |
|26 | Lepisorus clathratus (C.B. Clarke) Ching | Polypodiaceae | Herb | - - + - - - - | 14.28 | 0.18 |
|27 | L. nudus (Hook.) Ching | Herb | - - - + + + - | 42.85 | 0.54 |
|28 | Pyrosia mollis (Kunze) Ching | Herb | - - + - - - - | 14.28 | 0.18 |
|29 | Marsilea minuta L. | Marsiliaceae | Herb | - - - + + + - | 42.85 | 0.54 |

**Gymnosperms**

|   | Common Name | Family       | Life Form | Symbols | Percent | CI  |
|---|-------------|--------------|-----------|---------|---------|-----|
|30 | Pinus roxburgii Sarg. | Pinaceae | Tree | + - - - - - + | 14.28 | 0.18 |
|31 | Abies pindrow (Royle ex D.Don) Royle | Tree | - - - - - - + | 28.57 | 0.36 |
|32 | Cedrus deodara (Roxb. ex Lamb.) G. Don | Tree | - - - - - - + | 14.28 | 0.18 |
|33 | Pinus wallichiana A. B. Jacks. | Tree | + + + - - - + | 57.14 | 0.72 |

**Monocotyledon**

|   | Common Name | Family       | Life Form | Symbols | Percent | CI  |
|---|-------------|--------------|-----------|---------|---------|-----|
|34 | Arisaema jacquemontii Blume | Araceae | Herb | | 57.14 | 0.72 |
|35 | Iris germanica L. | Iridaceae | Herb | + + + - - - + | 28.57 | 0.36 |
|36 | Aristida funiculata Trin. | Poaceae | Herb | + + - - - - - | 57.14 | 0.72 |
|37 | A. abnormis Chiov. | Herb | + + + - - - + | 71.42 | 0.90 |
|38 | Brachiaria ramose (L.) Stapf. | Herb | + + + + + - - | 71.42 | 0.90 |
|39 | B. deflexa Schumach | Herb | + + + + + - - | 28.57 | 0.36 |
|40 | Calamagrostis decora Hook. | Herb | + + - - - - - | 71.42 | 0.90 |
|41 | Danthonia cachemyriana (Jaub) Spach | Herb | + + + + + - - | 71.42 | 0.90 |
|42 | D. schneideri Pilger | Herb | + + + + + - - | 28.57 | 0.36 |
|43 | Glyceria tonglensis (Clarke) L. | Herb | + + - - - - - | 28.57 | 0.36 |
|44 | G. plicata (Fries) Fries. | Herb | + + - - - - - | 71.42 | 0.90 |
|45 | Melica persica Kunth | Herb | + + + + + - - | 57.14 | 0.72 |
|46 | Microstegium nudum Trin | Herb | + + + - - - + | 71.42 | 0.90 |
|47 | Phacelurus speciosus Steud | Herb | + + + + + - - | 28.57 | 0.36 |
|48 | Phleum alpinum L. | Herb | + + - - - - - | 71.42 | 0.90 |
|49 | Piptatherum hilariae Pazij. | Herb | + + + + + - - | 28.57 | 0.36 |
| No. | Species-name                             | Category | Ethanol | Water | Acetic | Butanol | Methanol | Ethanol% | Water%  |
|-----|-----------------------------------------|----------|---------|-------|--------|---------|----------|----------|--------|
| 50  | *P. gracile* Mez.                        | Herb     | +       | +     | -      | -       | -        | 71.42    | 0.90   |
| 51  | *Stipa capillata* L.                    | Herb     | +       | +     | +      | +       | -        | 71.42    | 0.90   |
| 52  | *S. breviflora* Griseb.                 | Herb     | +       | +     | +      | +       | -        | 71.42    | 0.90   |
| 53  | *Steria pumila* (Poir) Roem & Schult    | Herb     | +       | +     | +      | +       | -        | 71.42    | 0.90   |
| 54  | *S. viridis*                            | Herb     | +       | +     | -      | -       | -        | 28.57    | 0.36   |
| 55  | *Cynodon dactylon* (L.) Pers.           | Herb     | +       | +     | -      | -       | -        | -        | 42.85  | 0.54   |
| 56  | *Dactylis glomerata* L.                 | Herb     | -       | -     | +      | +       | -        | 28.57    | 0.36   |
| 57  | *Chrysopogon serratulus* Trin.          | Herb     | -       | -     | +      | -       | -        | 28.57    | 0.36   |
| 58  | *C. aucheri* (Boiss.) Stapf             | Herb     | +       | +     | -      | -       | -        | 71.42    | 0.90   |
| 59  | *Digitaria sanguinalis* (L.) Scop.      | Herb     | +       | +     | +      | +       | -        | 57.14    | 0.72   |
| 60  | *Poa annua* L.                          | Herb     | +       | +     | -      | -       | +        | 57.14    | 0.72   |
| 61  | *P. nepleensis* Wall. ex Duthie.        | Herb     | +       | +     | -      | -       | +        | 71.42    | 0.90   |
| 62  | *Zizania aquatica* L.                   | Herb     | +       | +     | +      | +       | -        | 14.28    | 0.18   |
| 63  | *Dichanthium annulatum* (Forssk.) Staf  | Herb     | -       | -     | -      | -       | +        | 57.14    | 0.72   |
| 64  | *Phalaris minor* Retz.                  | Herb     | +       | +     | -      | -       | +        | 57.14    | 0.72   |
| 65  | *Themeda anthera* (Nees ex Steud.) Hack.| Herb     | +       | +     | +      | +       | -        | 14.28    | 0.18   |
| 66  | *Avena sativa* L.                       | Herb     | +       | -     | -      | -       | +        | 14.28    | 0.18   |
| 67  | *Phragmites australis* (Cav.) Trin. ex Steud. | Herb     | -       | -     | -      | -       | +        | 57.14    | 0.72   |
| 68  | *Andropogon gerardii* Vitman            | Herb     | +       | +     | -      | -       | +        | 14.28    | 0.18   |
| 69  | *Heteropogon contortus* (L.) P. Beu. ex R. & Sch. | Herb     | -       | -     | -      | -       | +        | 42.85    | 0.54   |
| 70  | *Stipa orientalis* Trin.                | Herb     | -       | -     | +      | +       | -        | 28.57    | 0.36   |
| 71  | *Panicum miliaceum* L.                  | Herb     | +       | +     | -      | -       | -        | 42.85    | 0.54   |
| 72  | *Agrostis viridis* Gouan                | Herb     | +       | +     | -      | -       | -        | 28.57    | 0.36   |
| 73  | *A. hissarica* Rozhev.                  | Herb     | +       | +     | -      | -       | -        | 42.85    | 0.54   |
| 74  | *Alopecurus himalaicus* Hook            | Herb     | -       | -     | +      | +       | -        | 28.57    | 0.36   |
| 75  | *A. aequalis* Sobol.                    | Herb     | -       | +     | -      | -       | -        | 42.85    | 0.54   |
| 76  | *Arundo donax* L.                       | Herb     | -       | -     | +      | +       | -        | 42.85    | 0.54   |
|   | Species                                                                 | Lifeform | Phenology | Ex. | Ext. |
|---|------------------------------------------------------------------------|----------|-----------|-----|------|
| 77| *Briza media* L.                                                      | Herb     | -         | +   | -    |
| 78| *Bromus inermis* Leyss.                                               | Herb     | -         | -   | -    |
| 79| *Carex brunnnea* Thunb.                                               | Cyperaceae| +         | +   | -    |
| 80| *C. buchananii* Berger.                                               | Herb     | -         | -   | -    |
| 81| *Cortaderia selloana* (Schult.) A. & Gr.                              | Herb     | -         | +   | +    |
| 82| *Calamagrostis acutiflora* (Schrad.) DC.                              | Herb     | -         | +   | -    |
|   | **Dicotyledons**                                                       |          |           |     |      |
| 83| *Habenaria digitata* Lindl.                                          | Orchidaceae| -         | -   | -    |
| 84| *Epipactis helleborine* (L.) Crantz                                   | Herb     |           |     | 14.28|
| 85| *Oenothera rosea* L. Her. ex Aiton                                    | Herb     | -         | -   | -    |
| 86| *Zingiber capitatum* Roxb.                                            | Zingiberaceae| -         | -   | -    |
| 87| *Amaranthus viridis* L.                                               | Amaranthaceae| -         | -   | -    |
| 88| *A. spinosus* L.                                                      | Herb     | -         | -   | -    |
| 89| *Achyranthes bidentata* Blume                                         | Herb     | +         | +   | +    |
| 90| *Mangifera indica* L.                                                | Anacardiaceae| +         | +   | +    |
| 91| *Hedera nepalensis* K.Koch                                          | Araliaceae| -         | +   | -    |
| 92| *Taraxacum officinale* Wabb                                          | Asteraceae| +         | -   | -    |
| 93| *Artemisia vulgaris* L.                                              | Herb     | +         | +   | -    |
| 94| *Bidens bipinnata* L.                                                | Herb     | -         | +   | +    |
| 95| *Conyza canadensis* (L.) Cronquist                                   | Herb     | +         | +   | -    |
| 96| *Lactuca sativa* L.                                                  | Herb     | +         | +   | -    |
| 97| *Helianthus annuus* L.                                               | Herb     | +         | +   | -    |
| 98| *Solidago virgaurea* L.                                              | Herb     | -         | -   | +    |
| 99| *Sonchus asper* (L.) Hill                                            | Herb     | -         | -   | +    |
|100| *Anaphalis spp.*                                                      | Herb     | +         | +   | -    |
|101| *Lactuca dissecta* D.Don                                             | Herb     | -         | +   | +    |
|102| *Achillea millefolium* L.                                            | Herb     | -         | -   | +    |
| No. | Species                          | Family       | Life Form | Rating | Habit     |
|-----|---------------------------------|--------------|-----------|--------|-----------|
| 103 | Berberis lycium Royle           | Berberidaceae| Herb      | 57.14  | - - + - + |
| 104 | Trichodesma indicum (L.) Lehm.  | Boraginaceae | Shrub     | 28.57  | + + + + - |
| 105 | Cynoglossum lanceolatum Forssk. | Herb        | - - + + + | 57.14  | 0.72      |
| 106 | Lepidium pinnatifidum Ledeb.    | Brassicaceae | Herb      | 57.14  | 0.72      |
| 107 | Buxus papillosa C.K. Schneid.   | Buxaceae     | Herb      | 42.85  | 0.54      |
| 108 | Sarcococa pruniformis Lindl.    | Shrub       | - - + + + | 57.14  | 0.72      |
| 109 | Impatiens spp.                  | Balsaminaceae| Shrub     | 14.28  | 0.18      |
| 110 | Commelina benghalensis L.       | Commelinaceae| Herb     | 28.57  | 0.36      |
| 111 | Solena amplexicaulis (Lam.) Gandhi | Cucurbitaceae | Herb     | 42.85  | 0.54      |
| 112 | Cuscuta reflexa Roxb.           | Cuscutaceae  | Herb      | 85.71  | 1.08      |
| 113 | Cucumis sativus L.              | Brassicaceae | Herb      | 28.57  | 0.36      |
| 114 | Lagenaria sicernaria (Molina) Standl. | Herb      | + + + + + | 28.57  | 0.36      |
| 115 | Momordica charantia L.          | Convolvulaceae| Herb     | 28.57  | 0.36      |
| 116 | Convolvulus arvensis L.         | Herb        | - + + + + | 28.57  | 0.36      |
| 117 | Ipomoea purpurea (L.) Roth      | Cucurbitaceae| Herb     | 28.57  | 0.36      |
| 118 | Campanula spp                   | Compositae   | Herb      | 14.28  | 0.18      |
| 119 | Siene spp.                      | Compositae   | Herb      | 14.28  | 0.18      |
| 120 | Chenopodium album L.            | Compositae   | Herb      | 42.85  | 0.54      |
| 121 | C. murale L.                    | Compositae   | Herb      | 57.14  | 0.72      |
| 122 | Cannabis sativa L.              | Cannabinaceae| Herb     | 28.57  | 0.36      |
| 123 | Vibernum nervosum D.Don         | Caprifoliaceae| Herb    | 14.28  | 0.18      |
| 124 | V. grandiflorum Wall. ex DC.    | Caprifoliaceae| Shrub    | 42.85  | 0.54      |
| 125 | Prosopis sinemaria (L.) Druce   | Cesaelpinaceae| Shrub    | 42.85  | 0.54      |
| 126 | Euphorbia helioscopia L.        | Euphorbiaceae| Shrub    | 28.57  | 0.36      |
| 127 | Diospyros kaki Thunb.           | Ebenaceae    | Herb      | 42.85  | 0.54      |
| 128 | D. lotus L.                     | Tree        | + + + + + | 14.28  | 0.18      |
| 129 | Elaeagnus umbellata Thunb.      | Elaeagnaceae | Tree     | 14.28  | 0.18      |
| No. | Species                              | Family         | Life Form | Abundance | Dominance |
|-----|--------------------------------------|----------------|-----------|-----------|-----------|
| 130 | *Quercus incana* Bartram             | Fagaceae       | Shrub     | + + + - - - - | 14.28 | 0.18 |
| 131 | *Swertia paniculata* Wall.           | Gentianaceae   | Tree      | - - - - - - +  | 14.28 | 0.18 |
| 132 | *Geranium willichianum* D.Don ex Sweet | Geraniaceae   | Herb      | - - - - - - +  | 14.28 | 0.18 |
| 133 | *Hypericum spp.*                      | Hypericeae     | Herb      | - - - - - - +  | 14.28 | 0.18 |
| 134 | *Juglans regia* L.                   | Juglandaceae   | Herb      | - - - - - - +  | 42.85 | 0.54 |
| 135 | *Mentha piperita* L.                 | Labiatae       | Herb      | + + + - - - - | 28.57 | 0.36 |
| 136 | *Stachys melissifolia* Benth.        | Herb          | Herb      | + + + - - - - | 42.85 | 0.54 |
| 137 | *Origanum vulgare* L.                | Herb          | Herb      | + + - - - - -  | 28.57 | 0.36 |
| 138 | *Malva sylvestris* L.                | Malvaceae      | Herb      | + + + - - - - | 42.85 | 0.54 |
| 139 | *Micromeria biflora* (Buch.-Ham ex D.Don) Benth. | Herb | Herb | + + + - - - - | 42.85 | 0.54 |
| 140 | *Ajuga integrifolia* Buch.-Ham.      | Herb          | Herb      | + + + - - - - | 14.28 | 0.18 |
| 141 | *Abutilon indicum* (L.) Sweet        | Herb          | Herb      | + + + - - - - | 28.57 | 0.36 |
| 142 | *Hibiscus esculentus* L.             | Herb          | Herb      | - - - - - - +  | 42.85 | 0.54 |
| 143 | *Acea rosea* L.                      | Labiatae       | Herb      | - - + - - + +  | 42.85 | 0.54 |
| 144 | *Melia azadarach* L.                 | Meliaceae      | Herb      | - - - + + + +  | 28.57 | 0.36 |
| 145 | *Acacia nilotica* Sehunach & Thonn   | Moraceae       | Tree      | - - + + + + +  | 28.57 | 0.36 |
| 146 | *Ficus carica* L.                    | Tree          | Tree      | + + - - - - -  | 14.28 | 0.18 |
| 147 | *F. palmata* Forsk.                  | Tree          | Tree      | + + + - - - -  | 42.85 | 0.54 |
| 148 | *Morus alba* L.                      | Tree          | Tree      | - - - - - - -  | 28.57 | 0.36 |
| 149 | *M. nigra* L.                        | Tree          | Tree      | + + + - - - +  | 57.14 | 0.72 |
| 150 | *Broussonetia papyrifera* (L.) Her. ex Vent. | Tree | Tree | - - + + + + - | 14.28 | 0.18 |
| 151 | *Eucalyptus citriodora* Hook.        | Myrtaceae      | Tree      | + + + - - - +  | 42.85 | 0.54 |
| 152 | *Jasminum grandi-florum* L.          | Oleaceae       | Tree      | - - + + + + +  | 57.14 | 0.72 |
| 153 | *J. officinale* L.                   | Oleaceae       | Shrub     | - - + + + + -  | 57.14 | 0.72 |
| 154 | *Oxalis corniculata* L.              | Oxalidaceae    | Shrub     | - + + - - + +  | 14.28 | 0.18 |
| 155 | *Polygonum bistorta* L.              | Polygonaceae   | Herb      | - - + + + + -  | 57.14 | 0.72 |
| 156 | *P. alpemin* All.                    | Herb          | Herb      | - - - - - - +  | 14.28 | 0.18 |
| Page | Plant Name                                      | Category | Growth Form | Flowering habit | Dry Mass | Biomass | Shade Tolerance |
|------|------------------------------------------------|----------|-------------|----------------|----------|---------|----------------|
| 157  | *Rumex dentatus* L.                           | Herb     | -           | -              | 57.14    | 0.72    |                |
| 158  | *Rumex nepalensis* Spreng                    | Herb     | -           | -              | 14.28    | 0.18    |                |
| 159  | *Persicaria nepalensis* (Meisn.) Miyabe      | Herb     | -           | -              | 57.14    | 0.72    |                |
| 160  | *Androsace rotundifolia* Hardw.              | Primulaceae | +           | +              | 14.28    | 0.18    |                |
| 161  | *Medicago lupulina* L.                       | Paplionaceae | +           | +              | 28.57    | 0.36    |                |
| 162  | *Phaseolus lunatus* L.                       | Herb     | -           | -              | 57.14    | 0.72    |                |
| 163  | *Robinia pseudoacacia* L.                    | Herb     | -           | -              | 57.14    | 0.72    |                |
| 164  | *Indigofera heterantha* Brandis              | Tree     | -           | -              | 14.28    | 0.18    |                |
| 165  | *Lotus aphaca* L.                            | Shrub    | -           | +              | 42.85    | 0.54    |                |
| 166  | *Trigonella foenum-graceum* L.               | Herb     | -           | -              | 28.57    | 0.36    |                |
| 167  | *Crotalaria medicaginea* Lam.                | Herb     | +           | -              | 28.57    | 0.36    |                |
| 168  | *Punica granatum* L.                         | Shrub    | -           | -              | 42.85    | 0.54    |                |
| 169  | *Plantago lanceolata* L.                     | Plantaginaceae | -           | +              | 14.28    | 0.18    |                |
| 170  | *Geum elatum* Wall. ex G.Don                | Rosaceae | Herb     | +           | 14.28    | 0.18    |                |
| 171  | *Eriobotrya japonica* (Thunb.) Lindl.        | Herb     | -           | -              | 28.57    | 0.36    |                |
| 172  | *Fragaria nubicola* (Hook.f.) Lindl. Ex Lacaita | Tree     | -           | -              | 14.28    | 0.18    |                |
| 173  | *Rosa indica*                               | Herb     | -           | -              | 42.85    | 0.54    |                |
| 174  | *Potentilla nepalensis* Hook.f.             | Shrub    | -           | -              | 42.85    | 0.54    |                |
| 175  | *P. fruticosa* L.                            | Herb     | -           | +              | 57.14    | 0.72    |                |
| 176  | *Duchesnea indica* (Andrews) Focke            | Herb     | -           | -              | 14.28    | 0.18    |                |
| 177  | *Malus pumila* Mill.                         | Herb     | -           | +              | 57.14    | 0.72    |                |
| 178  | *Prunus persica* (L.) Stokes                | Tree     | -           | -              | 57.14    | 0.72    |                |
| 179  | *P. armeniaca* L.                           | Tree     | -           | +              | 57.14    | 0.72    |                |
| 180  | *Pyrus pashia* Buch. –Ham. ex D.Don          | Tree     | -           | +              | 57.14    | 0.72    |                |
| 181  | *Prunus domestica* L.                        | Tree     | -           | +              | 42.85    | 0.54    |                |
| 182  | *Prunus bokhariensis* Royle                  | Tree     | -           | +              | 57.14    | 0.72    |                |
| 183  | *Malus sylvestris* Mill.                     | Tree     | -           | +              | 28.57    | 0.36    |                |
| No. | Species Name                      | Family       | Life Form | Presence Code | Index Code | Index  |
|-----|----------------------------------|--------------|-----------|---------------|------------|--------|
| 184 | Zanthoxylem allatum Roxb.        | Rutaceae     | Tree      | - - ++ + + + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 185 | Galium aparine L.                | Rubiaceae    | Shrub     | ++ - - + - - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 57.14 0.72 |
| 186 | G. Boreale L.                   | Rubiaceae    | Herb      | - + + - + - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 187 | Glema tic spp.                  | Ranunculaceae| Herb      | - - ++ + + + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 14.28 0.18 |
| 188 | Galium aparine L.                | Rubiaceae    | Herb      | - - ++ + + - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 189 | Hylicictrum foliolosum DC.       | Rubiaceae    | Herb      | - - - - - - + | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 57.14 0.72 |
| 190 | Ranunculus muricatus L.          | Rubiaceae    | Herb      | - - ++ + + - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 191 | Solanum nigrum L.               | Solanaceae   | Herb      | - - + + - - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 192 | Lycopersicum esculentum Mill.    | Solanaceae   | Herb      | - - ++ + + - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 193 | Cestrum nocturnum L.             | Solanaceae   | Herb      | - - ++ - + ++ | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 57.14 0.72 |
| 194 | Verbascum thapsus L.             | Scrophulariaceae | Shrub | ++ - - - + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 57.14 0.72 |
| 195 | Populus nigra L.                 | Salicaceae   | Herb      | + + - - + + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 196 | P. alba L.                       | Salicaceae   | Tree      | + + + + - - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 28.57 0.36 |
| 197 | Anethum graveolens L.            | Simaroubaceae| Tree      | - + + - + + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 57.14 0.72 |
| 198 | Urtica dioica L.                 | Urticaceae   | Herb      | - - - - - + - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 199 | Viola odorata L.                 | Violaceae    | Shrub     | - + - - + - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |
| 200 | Vitis vinifera L.                | Vitaceae     | Herb      | + + - - - - - | Lasdana, Mahmood Gali, Toliper, Khurshidabad, Kahutta, Hajiper, Kiran | 42.85 0.54 |

**Index:** L1 = Lasdana, L2 = Mahmood Gali, L3 = Toliper, L4 = Khurshidabad, L5 = Kahutta, L6 = Hajiper, L7 = 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 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).

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.
3.2. Percentage Distribution

Among pteridophytes, 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 philippensis, 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 dolomiae, 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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