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ASSESSMENT OF FLORISTIC DIVERSITY IN MIYAR VALLEY OF LAHAUL AND SPITI DISTRICT, HIMACHAL PRADESH, INDIA

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Abstract: *The floristic diversity assessment study was conducted in Miyar Valley, Lahaul & Spiti District, Himachal Pradesh in the year 2010, to understand the variation in floristic diversity along the altitudinal gradient. This assessment will provide baseline information, which will help in planning and implementation of conservation measures for valuable floristic wealth. The taxonomic diversity of the valley was represented by 117 plant species in which 11 are trees, 12 shrubs and 94 herbs. The dominant families are Asteraceae, Fabaceae, Lamiaceae and Polygonaceae. The Species Diversity Index in the valley was ranging between 1.68 to 2.08 for trees, 1.64 to 2.27 for shrubs and 3.19 to 3.85 for herbs. The 28 medicinally important plants are also recorded from the valley of which 23 are herbs and 5 are shrubs. The Allium stracheyi, Saussureacostus, Dactylorhizahatagirea, Eremurushimalaicus, Podophyllum hexandrum, etc. are the herbs having high conservation value recorded from the Miyar Valley.*

Keywords: Floristic Diversity, Miyar Valley, Himachal Pradesh

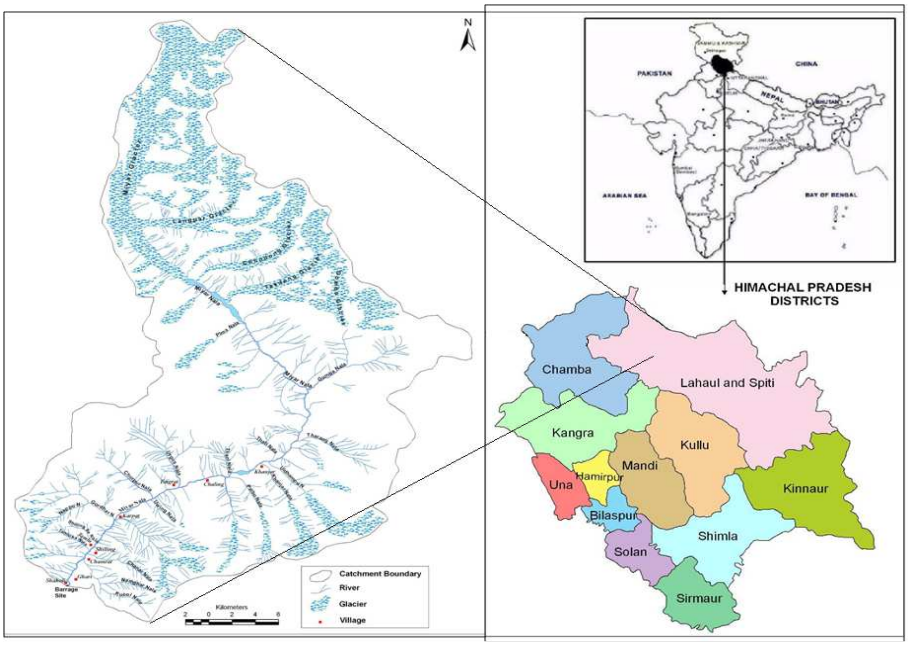
Introduction

The Himalayan region is blessed with diverse climate which support different habitats and ecosystems with equally diverse life forms.Miyar forms the North-Western part of Lahaul valley in Lahaul & Spiti district of Himachal Pradesh. This remote, fascinating valley of Lahaul is hidden behind the lofty Udaipur ranges and remains snow bound for over half the year and is amongst the most inaccessible areas in the region. Scanty rainfall, massive snowfall, high wind velocity, extreme temperature conditions from low to high, UV radiations, intense solar radiation and extreme xeric conditions are the common features of the area similarly as cold desert. The taxonomic studies of the valley were extensively studiedby Aswal and Mehrotra (1994), Murthi (2001), Kapoor and Jishtu (2008). The quantitative studies on vegetation structure of area was studied by Singh and Samant (2010) and Rawat *et.al.* (2010). The medicinal plant wealth of the area was extensively studied by Singh and Chauhan (2005),Singh and Brij Lal (2008), Singh *et.al.* (2009) and Sharma *et. al.* (2011). The species of high conservation importance was recorded by Badola and Pal (2000, 2003) and Shrivastava (2010) from the valley.During the short summer months, the alpine passes, mountain slopes, meadows and moraines blossoms with vegetation.The Miyar Valley possesses the influence of overgrazing by migratory livestock, removal of medicinal plant species, which results in loss of natural floristic diversity.If the naturally occurring floristic diversity will not timely conserved, then they may soon become extinct. In cold desert this genetic erosion coupled with soil erosion may retard the prospects of future economic development and welfare of the people. The systematic assessment of floristic wealth in the valley may provide a key for conservation. Keeping these aspects in view, a study was undertaken to document the altitudinal variation in floristic diversity of Miyar valley.

Study Area

Miyar Valley lies between 76° 40' 8.55" and 77° 01' 20.30"N lat and 33° 15' 17.13" and 32° 44' 23.38"E long with altitudinal range, 2800 to 5500 m.The location map of the valley is presented in figure 1.The climate varies from dry temperate to alpine type. The area remains snow covered almost for six months and receives average snowfall 120 to 400 cm/year and average rainfall 10 to 300 mm/year. The temperature ranges between -19^0 to 30^0 C. The valley is sparsely inhabited by the villages and the population are customarily depending on the agriculture and biodiversity for their livelihood.

Figure 1: Location map of Miyar Valley



Methodology

To understand the altitudinal variation in floristic diversity the valley is divided intothree altitude zones, i.e.lower zone (2800 – 3300m), lower alpine zone (3300 – 3800m) andalpine zone (>3800m) for conducting vegetation sampling for trees, shrubs and herbs. The quadrat method was followed to understand community structure. The random quadrat of sizes 10m x 10m, 5m x 5m and 1m x 1m for trees, shrubs and herbs respectively(Dhar *et al*., 1997) was laid. The relative values of density, frequency and dominance were summed to get Importance Value Index (IVI) of individual species (Curtis & McIntosh, 1950). The abundance to frequency ration (A/F) of different species was determined for eliciting the distribution pattern. This ration indicates regular (<0.025), random (0.025 – 0.050) and contiguous (>0.05) distribution (Curtis and Cottam, 1956). The specimens of the species were collected from each quadrates and identified with the help of floras.The species diversity was calculated by using Shannon-Weaver diversity index (H)(Shannon and Weaver, 1963) and Evenness index (E) (Hills, 1973).

Results and Discussion

Floristic Diversity

The taxonomic diversity of Miyar valley was represented by 117 species, of which 11 trees, 12 shrubs and 94 herbs. The species recordedfrom the valley is lower than recorded species in flora of Lahaul & Spiti Dist. (Aswal and Mehrotra, 1994) and flora of Himachal Pradesh (Chowdhery and Wadhwa, 1984). The four dominant families in the Miyar valley areAsteraceae, Fabaceae, Lamiaceae and Polygonaceae where as Aswal and Mehrotra (1994) reported Asteraceae, Poacese, Brassicaceae and Fabaceae as dominant families for

Lahaul and Spiti Dist. and Rau (1975) in his work on West Himalay recorded Poaceae, Asteraceae, Leguminosae and Cyperace as the dominant families.

Altitudinal Variation

The tree layer shows variation in species composition and density as the elevationincreases in the Miyar Valley. The maximum density of the trees was recorded on the lower zone (580 per ha) and minimum at lower alpine zone (475 per ha) (Table 1). At lower zone the tree community was represented by mix type of forest mainly composed of*Cedrus deodara* (IVI – 84.36) and *Pinus wallichana* (IVI – 55.87), whereas at lower alpine zonethe tree community was dominated by *Juniperus recurva* (IVI – 108.53) (Table 2). Species richness in shrub layer is highest (12 species) at lower zone with mixed type of community represented by *Rosa webbiana* (IVI – 60.55)*, Lonicera quinquelocularis* (IVI – 49.31), *Sorbaria tomentosa* (IVI – 32.64) and *Juniperus communis* (IVI – 31.06). Where as in lower alpine zone species richness was 6 and dominated by *Lonicera quinquelocularis* (IVI – 94.91) and followed by *Juniperus communis* (IVI – 65.98) (Table 3). The herb layer in lower elevation was represented by 54 species and dominated by species like *Artemisia nilagirica, Dactylorhiza hatagirea, Polygonum affine, Trifolium pratense,* etc. The lower alpine zone showsa higher number of herb species (59), mainly composed of *Artemisia wallichiana, Bromus japonicus, Polygonum affine, Potentilla atrosanguinea, Ranunculus munroanus* and *Veronica persica.* The alpine zone was dominated by perennialherbs like *Androsace muscoidea, Biebersteinia odora, Draba oreades, Draba setosa, Potentilla atrosanguinea, Sibbaldia purpurea*, etc. In similar studies from Jhalma Nala by Rawat *et. al.* (2010) recorded *Salix fragilis*, *Populus nigra* and *Juniperus recurva* as a dominant trees *and Hippophae rhamnoides* and *Rosa webbiana* as the dominant shrubs. Kumar *et. al.* (2013) in their studies fromthe Pangi Valley recorded *Cedrus deodara, Pinus wallichiana, Corylus jacquemontii, Celtis australis, Pinus gerardiana,* etc. as the dominant trees.

Distribution Pattern

The abundance and frequency ratio (A/F) recorded from the Miyar valley for all trees, shrubs and herbs show the contagious species distribution, except *Juniperus communis* has random distribution, because of cluster formation habit.The contiguous distribution recorded in the valley is the common feature in the natural habitat (Verma and Kapoor, 2011).

Table 1: Altitudinal variation in density (per hectare)

Elevation (m)	Plant category	Density (per hectare)
Alpine zone (> 3800)	Herbs	168182
Lower alpine zone (3300 – 3800)	Trees	475
	Shrubs	1580
	Herbs	206400
Lower zone (2800 – 3300)	Trees	580
	Shrubs	2286
	Herbs	209545

Table 2: Tree layer variation in Miyar Valley

Trees		Lower zone (2800 - 3300m)					Lower alpine zone (3300 - 3800m)				
#	Species	D (ha)	F (%)	A	A/F	IVI	D (ha)	F (%)	A	A/F	IVI
1	*Betulautilis*						150	25.00	6.0	0.24	60.79
2	*Cedrusdeodara*	120	40.00	3.0	0.08	84.36					
3	*Fraxinusxanthoxyloides*	50	30.00	1.7	0.06	23.10					
4	*Juglansregia*	40	20.00	2.0	0.10	22.93					
5	*Juniperusrecurva*	100	40.00	2.5	0.06	43.51	117	25.00	4.7	0.19	108.53
6	*Piceasmithiana*	50	20.00	2.5	0.13	19.73	33	16.67	2.0	0.12	24.97
7	*Pinuswallichiana*	100	40.00	2.5	0.06	55.87	100	25.00	4.0	0.16	58.80
8	*Populuscaspica*	50	20.00	2.5	0.13	19.78	17	8.33	2.0	0.24	12.20
9	*Robinia pseudo-acacia*	50	20.00	2.5	0.13	18.60					
10	*Salix alba*	20	20.00	1.0	0.05	12.12	33	16.67	2.0	0.12	21.38
11	*Salix fragilis*						25	8.33	3.0	0.36	13.35
Note: D (ha): Density (per ha), F(%): Frequency, A: Abundance, A/F: Abundance/ Frequency, IVI: Importance Value Index											

Table 3: Shrub layer variation in Miyar Valley

		Lower zone (2800 - 3300m)					Lower alpine zone (3300 - 3800m)				
#	Species	D (ha)	F (%)	A	A/F	IVI	D (ha)	F (%)	A	A/F	IVI
1	*Berberisjaeschkeana*	143	14.29	2.5	0.18	15.34	240	25.00	2.4	0.10	47.11
2	*Berberispanchyacantha*	86	14.29	1.5	0.11	12.25					
3	*Cotoneaster duthieanus*	57	7.14	2.0	0.28	6.64					
4	*Ephedra intermedia*	57	7.14	2.0	0.28	5.56					
5	*Juniperuscommunis*	229	42.86	1.3	0.03	31.06	480	25.00	4.8	0.19	65.98
6	*Juniperusindica*	114	21.43	1.3	0.06	20.50	80	10.00	2.0	0.20	18.05
7	*Loniceraquinquelocularis*	514	28.57	4.5	0.16	49.31	420	30.00	3.5	0.12	94.91
8	*Ribeshimalense*	143	21.43	1.7	0.08	16.92					
9	*Ribiesorientale*	229	28.57	2.0	0.07	29.57					
10	*Rosa webbiana*	314	28.57	2.8	0.10	60.55	200	30.00	1.7	0.06	42.91
11	*Salix lindleyana*	86	14.29	1.5	0.11	19.65	160	15.00	2.7	0.18	31.03
12	*Sorbariatomentosa*	314	35.71	2.2	0.06	32.64					
Note: D (ha): Density (per ha), F(%): Frequency, A: Abundance, A/F: Abundance/ Frequency, IVI: Importance Value Index											

Diversity

Along the latitudinal gradient the highest species diversity index for trees, shrubs and herbs was recorded at lower elevation (2.08, 2.27 and 3.85 respectively) and as the elevation increase than there was a decline in the species diversity index.The reduction in the species diversity index was due to the low soil content, moisture and due to the heavy grazing pressure along with the continuous extraction of medicinal plants. The evenness index for tree, shrubs and herbs wereranging between 0.86 to 0.97.

Table 4: Species diversity and Eveness index variation in Miyar Valley

Elevation (m)	Plant category	Shannon-Wiener Diversity Index (H)	Evenness Index (E)
Alpine zone (> 3800)	Herbs	3.19	0.93
Lower alpine zone (3300 – 3800)	Trees	1.68	0.86
	Shrubs	1.64	0.92
	Herbs	3.85	0.94
Lower zone (2800 – 3300)	Trees	2.08	0.95
	Shrubs	2.27	0.91
	Herbs	3.85	0.97

Important Plants

During the floristic diversity survey 28 medicinally important plants recorded from the valley from which 23 are herbs and 5 are shrubs. The herbs having medicinal value are *Allium stracheyi, Aster flaccidus, Bunium persicum, Colchicum luteum, Cousinia thomsonii, Dactylorhiza hatagirea, Eremurus himalaicus, Hyoscyamus niger, Iris kemaonensis, Meconopsis aculeata, Medicago falcate, Nepeta longibracteata, Nepeta nervosa, Pedicularis pectinata ssp. pectinata, Phlomis bracteosa, Plantago major, Pleurospermum govanianum, Podophyllum hexandrum, Polygonum affine, Silene edgeworthii, Taraxacum officinale, Thimus linearis* and *Trigonella emodi*.Singh and Lal (2008) recorded 58 species and Sharma *et. al.* (2011) in their studies on Lahaul Valley recorded 354 plant species having medicinal and aromatic importance. Devi and Thakur (2011) and Rani *et. al*. (2013) studied 25 and 50 species, respectively from Pangi Valley having ethno-medicinal importance.*Berberis jaeschkeana, Berberis panchyacantha, Juniperus communis, Rosa webbiana* and *Saussurea costus*are the important shrubs having medicinal importance.*Saussurea costus* and *Dactylorhiza hatagirea* are important species under cultivation in the valley for its roots having high value in the market.

Conclusion

The major threats to floristic diversity in the valley are expansion of agricultural, overgrazing by domestic animals, uncontrolled and unscientific extraction important medicinal plant species from their habitats and development of roads and hydropower projects.To minimize the impacts on the floristic diversity, there is an urgent need for the conservation of important habitats in valley by implementing scientific conservation measures, such as cultivation of important medicinal plants, timber, fuel wood plants, and minimisation of dependence of locals on the forest area. The regulation or rotational grazing in higher riches (alpine pastures) of the valley, willsupport in regeneration and multiplication of herbaceous species. Support to local people for skill based training and other livelihood options. Implementation of the above measure, in time bound manner will help in mitigation of impacts on the floristic diversity of Miyar valley.

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