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Life form and biological spectrum of Indus Valley in Lower Ladakh region, J&K

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Abstract

Complete enumeration of floristic composition revealed the presence of 208 plant species belonging to 121 genera and 49 families which have been classified into various life forms classes after Raunkiaer (1934) to prepare a biological spectrum to represent climatic condition of the area. Hemicryptophytes (45.19%) and Therophytes (23.07%) dominated the landscape of this area followed by Chamaephyte (14.90%), Phanerophytes (8.17%) and Geophytes (8.17%). Higher percentage of Hemicryptophytes and Therophytes indicate the arid nature of the region with scanty precipitation and sparse vegetation. Compared to the normal biological spectrum of Raunkiaer, Phanerophytes showed maximum deviation (-37.83) followed by Hemicryptophytes (+19.19) and Therophyte (+10.07).

Keywords: ***biological spectrum, Indus valley, Ladakh region, life forms.***

Introduction

The distribution pattern of vegetation at global level depends on climatic conditions like precipitation, pressure, humidity; however at smaller scale factors like lithology, slope, altitude which forms the overall microclimate of that area plays key role in the distribution of vegetations (Kharkwal *et al.*, 2005). In the mountains of the Himalaya, where vegetations are highly sensitive to climate related factors (Gaur *et al.*, 2005; Kullman, 2010), topography is the major controlling factor in vegetation growth with climatic factors playing secondary role. Under topography elevation, aspect and slope are the three main factors that control the pattern of vegetation distribution (Radcliffe, 1982). Micro climate of the area also determines the position of the perennating bud on the plants with respect to the surface of the soil. On the basis of the position of renewal buds/ perennating buds on different heights of the plants, plants are grouped into different life forms. The distribution of the vegetations in different life forms in terms of percentage is called biological spectrum which embody the climatic condition of a particular area being regarded by the term phytoclimate (Danin and Orshan, 1990; Nautiyal *et al.*, 2001). The portion of Indus Valley (34° 34'53.82"-34°35'34.06" N and 76° 31'40.41"-76°38.28" E) where the present investigation has been carried out lies in the north western part of Ladakh region which is also called as lower Ladakh region. It is a small watershed bordering the districts of Kargil and Leh and ranges in height from 2500 m to 4500 m from mean sea level. River Indus which passes through the valley originates from China and enters the Ladakh region from the south eastern part of Leh district. Maximum portion of the river lies in Leh district (Upper Ladakh region) whereas in present study area of Lower Ladakh region, located in Kargil district, it passes through villages like Hanu, Dah, Garkon, Batalik before crossing the line of control (Fig. 1). The valley has a narrow stretch of plain area on both the sides of the river with scrub forest on its margin. The valley is surrounded by large steep mountains on both the sides. Temperature and humidity remains relatively high with fertile alluvial soil around the vicinity of the river whereas the upper parts of the valley have arid and desert type of climate, typical of Ladakh. Although a number of studies on the life form classes and biological spectrum have been carried out in western Himalayan regions (Rana *et al.*,

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2002; Pharswan *et al.*, 2010; Khan *et al.*, 2011; Khan *et al.*, 2012) with few of them being in Ladakh (Klimes, 2003; Rawat and Adhikari, 2005; Dvorsky *et al.*, 2011; Raina and Hamid, 2014; Dvorský *et al.*, 2015), the present study region has been explored for the first time with such an objective in mind.

Materials and Methods

The present study has been conducted in Indus valley located in N-W part of Ladakh (Lower Ladakh region) during the period from July to September 2014 and again repeated during July to September 2015 and 2016. Field trips have been carried out in the plain as well as the mountains areas of the study region covering different habitats and altitudinal zones. Plants specimens of the study area have been collected, photographed and identified by using various local, regional and national floras and also by consulting herbarium of Department of Botany, University of Jammu and Wildlife Institute Dehradun. Taxonomic experts of the region were also consulted for the purpose of identification. Representatives of all recorded plant species were examined for locating their perennating parts and grouped into lifeform classes as per Raunkiaer's (1934). Due care has been taken to avoid unnecessary damage to the plants and their habitat. Raunkiaer's biological spectrum was calculated as.

$$Biological\ Spectrum = \frac{No.\ of\ species\ falling\ in\ a\ particular\ life\ form}{Total\ no.\ of\ all\ the\ species\ collected}\ X\ 100$$

Results and Discussion

A total of 208 plant species belonging to 121 genera and 49 families recorded from the study region have been classified into the life forms as per Raunkiaer (1934) and the data has been presented in Table 1. Biological spectrum of the study area has been prepared on the basis of the percentage value of species falling under each life form and has also been presented in Table 1. Perusal of table revealed that hemicryptophytes (45.19%) dominates the landscape of the study area followed by therophytes (23.07%), chamaephyte (14.90%) and phanerophytes (8.17%) and geophytes (8.17%).

Table 1. Life form classification and biological spectrum of species and deviation from Raunkiaer's Normal Spectrum in Lower Ladakh region of North West Himalaya.

SN	Life form classes	No. of species	Biological spectrum (%)	Raunkiaer's Normal Spectrum	Deviation
1	**Phaneorophytes**	17	8.17	46	-37.82
2	**Chaemaephytes**	31	14.90	9	+5.90
3	**Hemi-cryptophytes**	94	45.19	26	+19.19
4	**Geophytes**	17	8.17	6	+2.17
5	**Therophytes**	48	23.07	13	+10.07
6	**Lianas**	01	0.48	0	
	Total	208	100	100	

Table 2. Comparison of biological spectrum from the study area with eastern Ladakh, Kargil and Chiktan valley.

Life forms	He	Th	Ch	Ge	Na	Ma	Hy	Ep	Li
Eastern Ladakh (Klimes, 2003)	62.10	22.30	5.40	4.20	3.50	0.00	1.70	0.00	0.00
Kargil (Sharma, 2009)	37.19	25.61	15.09	10.88	5.26	3.86	1.70	0.00	0.35
Chiktan valley (Raina and Hamid)	40.50	24.05	17.72	8.86	7.59	1.26	0.00	0.00	0.00
Indus valley (Present study)	45.19	23.07	14.90	8.17	5.76	2.40	0.00	0.00	0.48

He= Hemicryptophyte; Th= Therophyte; Ch= Chaemaephyte; Ge= Geophyte; Na= Nano-phaneorophyte; Ma= Macro- phaneorophyte; Hy= Hydrophyte; Ep= Epiphyte; Li= Lianas

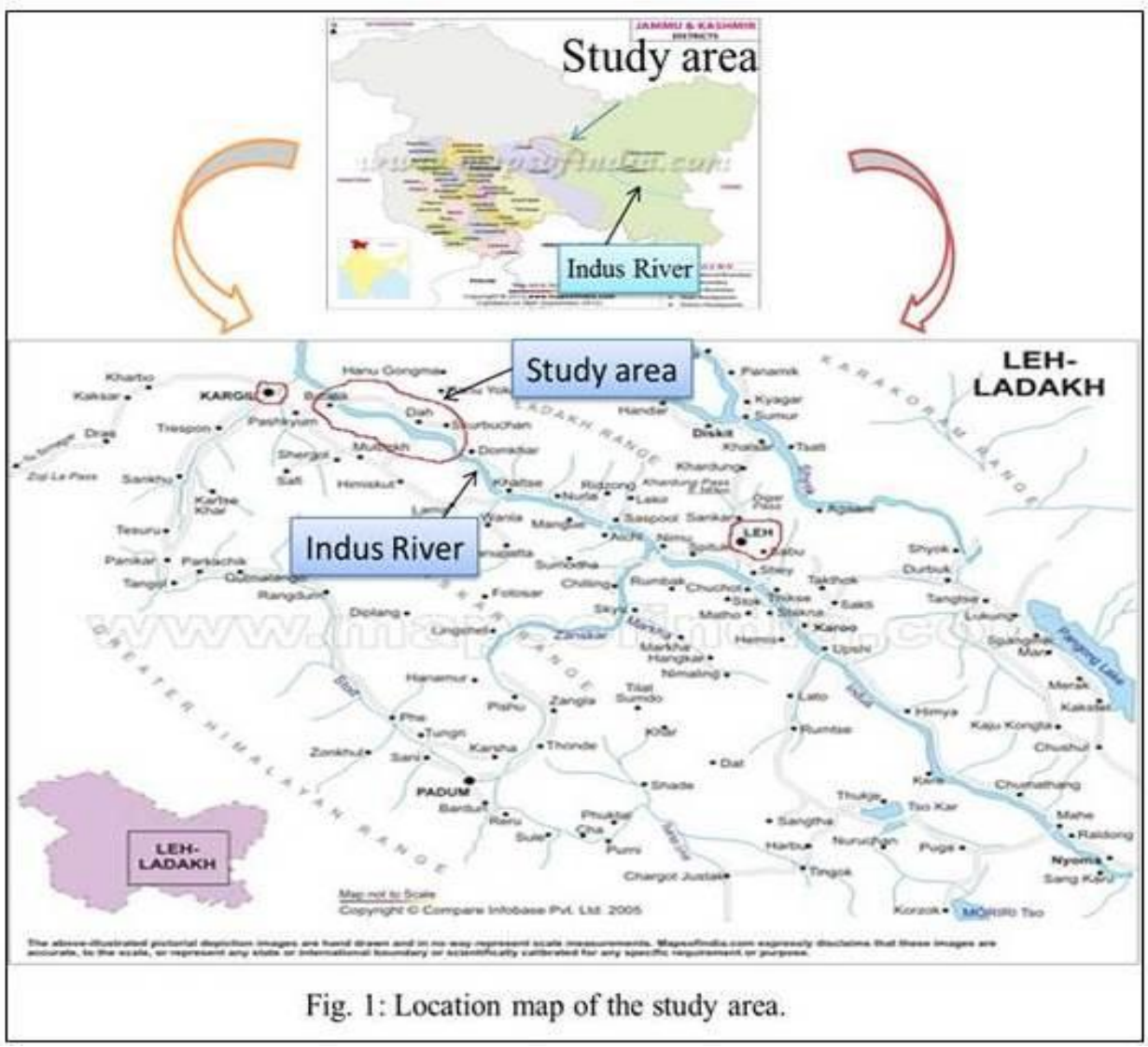

Fig. 1: Location map of the study area.

On comparison of the biological spectrum of the study region with Raunkiaer's normal biological spectrum (Table 1 and fig. 2), maximum deviation of -37.82 has been recorded in case of phaneorophytes followed by hemi-cryptophytes (+19.19), therophytes (+10.07), chamaephyte (+5.90) and geophytes (+2.17). The small number of plants with phaneorophytic life form may be attributed to the virtual absence of trees as Ladakh is essentially a cold desert with most of the areas lying in the alpine zone of the Himalayas.

On the basis of dominance of hemicryptophytes and therophytes, the phytoclimate of the area as per the Raunkiaer terminology, may be described as Hemicrypto-Therophytic type. The higher percentage of hemicryptophytes and therophytes is the characteristic of arid climate and the Ladakh region exhibiting this type of climatic condition exhibit sparsely distributed pattern of vegetation with higher percentage of plant species having hemicryptophytes and therophytes type of life forms. The works conducted by Klimes (2003); Sharma (2009) and Raina and Hamid (2014) in different parts of Ladakh under similar climatic and geographic conditions also revealed the higher percentages of hemicryptophytes and therophytes (Table 2; fig. 3, 4 & 5). Similar results have also been reported by Rawat and Adhikari (2005) and Dvorsky *et al.* (2011) in other parts of Ladakh. Biotic pressure (Barucha and Dave, 1944)

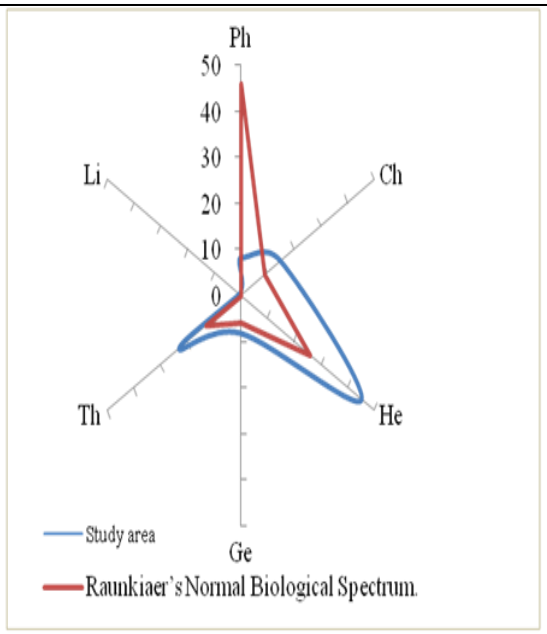

Fig. 2: Comparison of Biological spectrum of the study area with Raunkiaer's Normal Biological Spectrum.

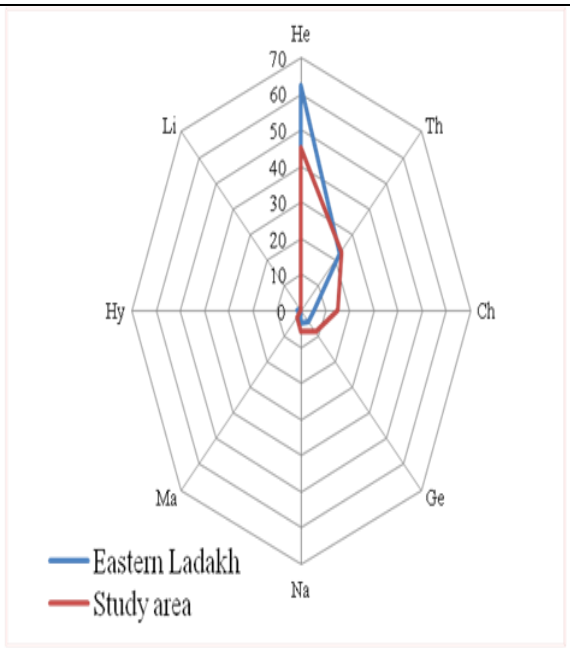

Fig. 3: Comparison of Biological spectrum of the study area with eastern Ladakh.

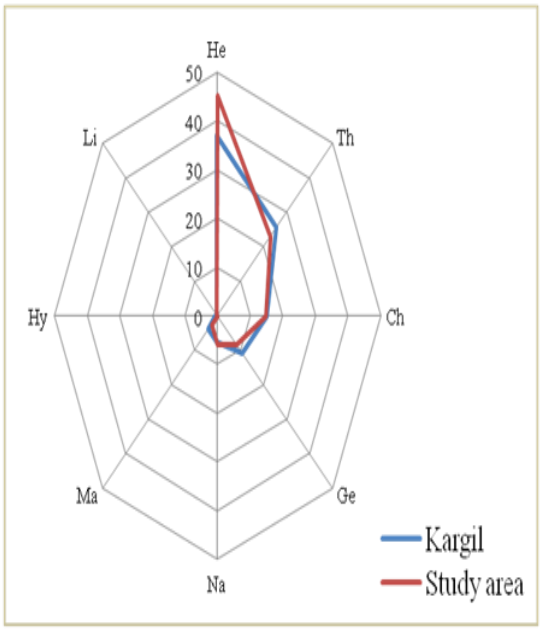

Fig. 4: Comparison of Biological spectrum of the study area with Kargil.

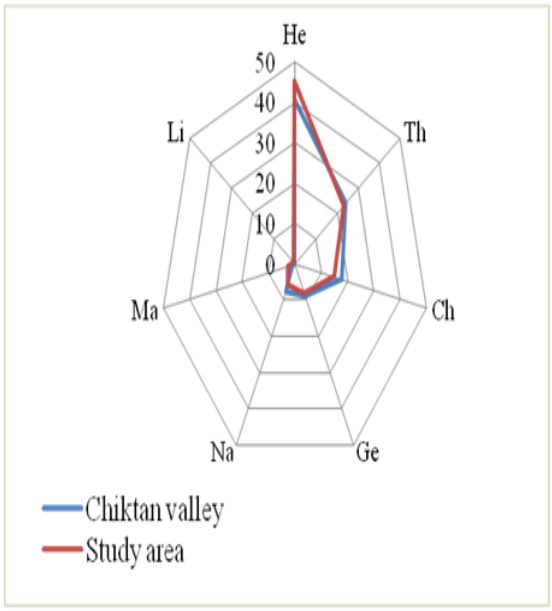

Fig. 5: Comparison of Biological spectrum of the study area with Chiktan Valley.

involving grazing (Yadav and Singh, 1977) is an important factor that leads to higher percentage of therophytes in any region of the world. Sharma and Rajpal (1991) has, however, reported relatively less percentage of therophyte in Ladakh as compared to other regions having similar climatic conditions which indicate that biotic pressure, though existing in the valley, is less as compared to other area.

Conclusion

Lower Laddakh region (N-W Ladakh), essentially a cold desert with negligible precipirtation and dry climate, has low species diversity with higher percentage of annuals and biennials while few tree species are virtually restricted along the river in the valley. Corresoponding to climatic condition, valley is depicting hemicrypto-therophytic type of phyto climate as per the Raunkiaer terminology.

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