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Life form classification and biological spectrum of Chiktan valley, North West Himalaya

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Abstract

The life form classification and construction of biological spectrum of Chiktan valley of Kargil district in Ladakh region of North West Himalaya has been done after complete enumeration of floristic composition. A total of 79 plant species has been listed and grouped into various life form classes after Raunkiaer (1934). Hemicryptophytes (40.50%) and Therophytes (24.05%) dominated the landscape of this area followed by Chamaephyte (17.72%), Phanerophytes and Geophytes (8.86%). The life form spectrum was the characteristic of desert climate with scanty rainfall and steppe vegetation. Compared to the normal biological spectrum of Raunkiaer, Phanerophytes showed maximum deviation (-37.14) followed by Hemicryptophytes (+14.50) and Therophyte (+11.50).

Keywords: Biological spectrum, Chiktan valley, desert climate, Kargil, Ladakh, Life forms

Introduction

The presence of a particular kind of vegetation in a particular area is the result of interaction of a number of factors like lithology, slope, altitude and above all the climate of that area (Kharkwal *et al.*, 2005). The growth form or life-form composition of a community is the adaptation of its component species to the climatic condition of the area which it manifests by the presences of its penetrating buds on different heights of its body. Raunkiaer's (1934), system of classifying the plant species into different life forms is the most accepted and commonly used system. According to this system, plant species can be grouped into five main classes viz phanerophytes, chamaephytes, hemi cryptophytes, cryptophytes and therophytes. The percentage of various lifeform classes put together constitutes the biological spectrum. The life-form spectrum gives basic climatic information of a particular area (Danin and Orshan, 1990) as it is based on the degree of protection of the buds during adverse climatic condition. It also helps to compare climatic conditions of geographically wide regions. Ladakh, the moon land, constitutes the major portion of the cold desert of North West Himalaya in India and is situated about 3000 to 8000 meter above sea level. Precipitation is small that too mostly in the form of snow, which is associated with the extra-tropical disturbances of mid-latitudes known as ‘‘Western Disturbances’’ (Dhar and Mulye, 1987). The vegetation of this cold desert exhibits low levels of richness, diversity and productivity (Sharma *et al*., 2009; Grytnes and Vetaas, 2002). The vegetation is dominated by herbs and shrubs which are sparsely distributed with small number of trees in between (Chaurasia and Singh, 1997; Rawat and Adhikari, 2005). Chiktan Valley (34°22'33.4"-34°34'45.7" N latitude and 76°31'22"-76°31'43.79"E longitude) of Kargil district (Fig. 1) where the present study has been carried out, forms one of the nine administrative blocks of the district.

There is a small stream called Kanji Nallah on the vicinity of which the villages are situated. The stream originates from a small glacier on Kargil-Leh highway and after passing through various villages of Chiktan valley for about 12 km mixes with the water of Indus river. On an average less than half a kilometer of areas on the vicinity of the stream are plain. The plain areas are dominated by the cultivable fields which remains lush green with wheat and barley from May to August. Rest of the area away from the stream is constituted by hilly slopes with gorges at some places which remains prone to flood during the peak rainy season in

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August. As in rest of Ladakh, the climate of this valley is arctic and alpine with some micro climatic condition within this main climate. The growing season is short, rainfall is low and soil is poor in nutrients. Majority of people are Muslims with few Buddhists at scattered places. A few studies on life form composition and biological spectrum in other similar climatic conditions were carried out by workers like Rana *et al*., (2002) and Klimes (2003). However the present work is first of its kind in that direction in the present study region.

Material and Methods

The study has been carried out from July to September 2012 and also repeated in 2013. The floristic composition has been recorded separately for the plain and mountainous region. A number of field trips were undertaken extensively to both the classified regions. Care was taken to cover all the possible habitats especially in the undulating slopes of the mountainous region. Majority of the plants were identified on spot by their vernacular names. Plants have also been photographed to depict floral status. The botanical names of the plants were identified with the help of relevant literatures and various herbaria of the region. Taxonomic experts were also consulted to validate the authenticity of the names. Representatives of all recorded herbaceous plant species were dug out and their below-ground organs were examined and classified within the life-form system. Life-forms were defined according to Raunkiaer's (1934) based on the position of the penetrating/renewing buds in relation to the soil surface. The observations were cross validated by comparing the observed life form of the representative plants with their life forms found in the literature. Raunkiaer's biological spectrum was calculated as follows.

Biological spectrum
= (No. of species falling in particular lifeform class)
/(Total no. of all species collected) X 100

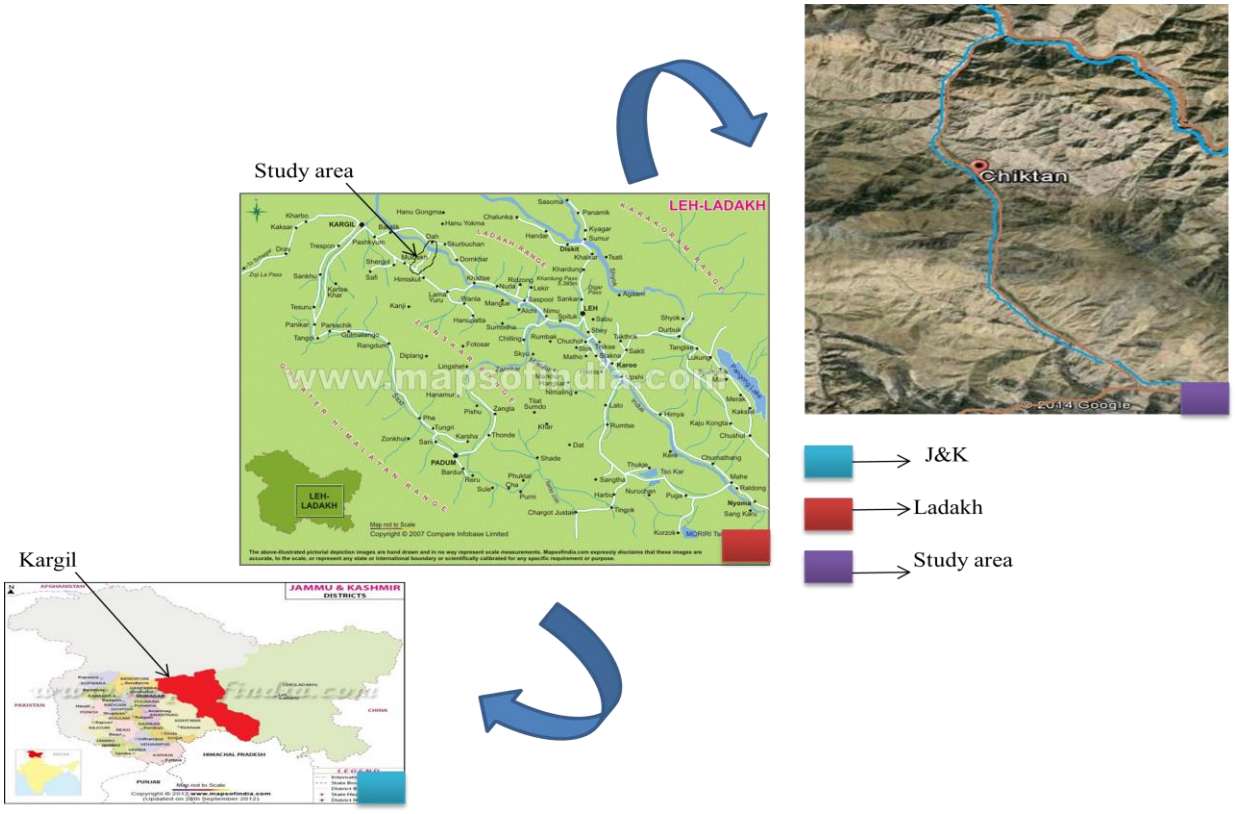

Fig1. Location map of the study area

Results and Discussion

A total of 79 species collected from the study area have been classified into the life forms as per Raunkiaer's (1934) and the data has been presented in Table 1. Based on the percentage value of each life form, biological spectrum of the study area has been obtained and has been compared with Raunkiaer's Normal Biological Spectrum of phanerophytic climate (Table 1and fig. 2). A comparison of the Biological spectrum of present study with that of Klimes (2003) and Kumar (2009) have been presented in Table 2 and fig. 3.Perusal of the table 1 revealed that Hemicryptophytes (40.50%) and Therophytes (24.05%) dominated the landscape of this area followed by Chamaephyte (17.72%) and then Phanerophytes and Geophytes (8.86%). On this basis the phytoclimate of the area as per the Raunkiaer terminology, may be described as Hemicrypto-Therophytic type. The Hemicryptophytes are plants of cold and dry climate. They have their renewal buds on the surface of the ground to overcome the harsh climatic conditions. The climate of the study area is dry with scanty rainfall. This has also found support from the work done by Klimes (2003) and Kumar (2009).A higher Hemicryptophytic and Therophytic percentage is the characteristic of desert steppe represented by small grasses without trees. Although trees have been excluded from the study, still it has not affected the life form as only a few species of trees like willow and popular (that too are cultivated) have been recorded from the study area. Biological spectrum of a particular area may gets changed due to change in agriculture practices and other biotic disturbance but in the present study since only the wild species of plants have been recorded, the biological spectrum represents the true picture of the indigenous climatic condition of the area. Phanerophytes showed maximum deviation (-37.14) followed by Hemicryptophytes (+14.50) and Therophyte (+11.05) from the normal spectrum of Raunkiaer.

At high altitude, optimum climatic conditions like temperature, moisture, wind etc are not available for living organisms. Hence diversity of life-forms decrease with increasing altitude as was recorded by Klimes (2003) in eastern Ladakh. Similarly in the present study too, plants are not

Table 1: Total number of species, percentage of different Life form classes and their deviation from Raunkiaer's Normal Spectrum

S.No.	Life form classes	No. of Species	Percentage (%)	Raunkiaer's Normal Spectrum	Deviation from Normal
1.	Phanerophytes (P)	7	8.86	46	-37.14
2.	Chamaephytes (Ch)	14	17.72	9	+8.72
3.	Hemi-cryptophytes (H)	32	40.50	26	+14.50
4.	Geophytes (G)	7	8.86	6	+2.86
5.	Therophytes (Th)	19	24.05	13	+11.05
	Total	**79**	**100**	**100**	

Table 2: Comparison of life forms from the study area with eastern Ladakh and Kargil.

S. No.	Life Form	Eastern Ladakh (Klimes, 2003)	Kargil (Kumar, 2009)	Chiktan valley (Author, 2013)
1.	Phanerophytes (P)	3.50	9.12	8.86
2.	Chamaephytes (Ch)	5.40	15.09	17.72
3.	Hemi-cryptophytes (H)	62.10	37.19	40.50
4.	Geophytes (G)	4.20	10.88	8.86
5.	Therophytes (Th)	22.30	25.61	24.05

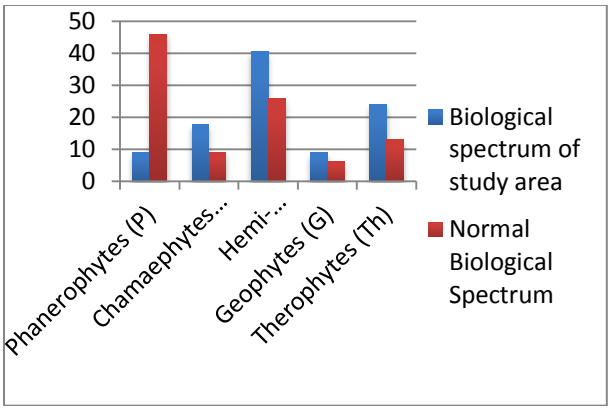

Fig.2: Comparison of Biological spectrum of the study area with Raunkiaer's Normal Biological Spectrum

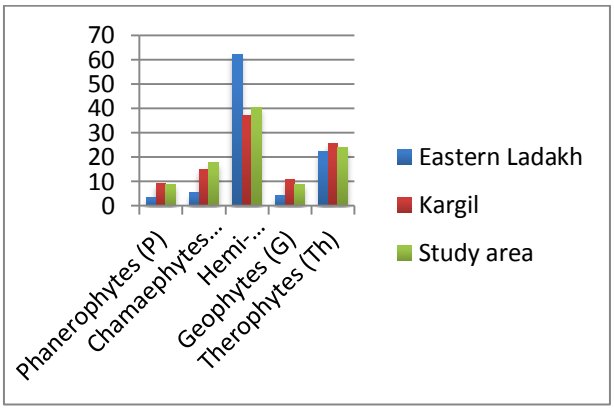

Fig. 3: Comparison of life forms from the study area with eastern Ladakh and Kargil.

distributed among all life forms as shown by the zero number of species as climbers/lianas, epiphytes and hydrophytes and only few species as phanerophytes and geophytes. Deserts are under intense biotic pressure in the form of grazing and hence they are generally dominated by therophytes (Khan *et al.*, 2011; Khan *et al.*, 2012) which complete their life cycle in a single growing season. Life-form spectra in the whole Ladakh region has been found markedly different from those reported from typical deserts in India (Sharma and Rajpal, 1991) and other parts of the world (Tareen and Qadir, 1993).Therophytes, which usually attains 30 to 55% of species in (semi-) deserts (Sharma and Rajpal, 1991) have been found to be represented by only 24% of species in the study area. This can be attributed to the fewer biotic disturbances in the study region which has enhanced the percentage presence of hemicyyptophyte and chamaephyte at the cost of therophytes.

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