

Ethnobotanical Studies of Plant Species Associated with *Hippophae* sp. in Chandra Valley a Part of Cold Desert Biosphere Reserve Himachal Pradesh, India

Praveen Kumar¹, Virendra Singh², Ashok Singh³ and Suresh Kumar^{*4}

¹School of Earth and Environmental Sciences, Central University of Himachal Pradesh - 176 215 (HP) India

²Department of Biology and Environmental Sciences, Ch. Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur - 176 062 (HP) India

³Krishi Vigyan Kendra Lahaul and Spiti at Kukumseri, Camp Office at Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur - 176 062 (HP) India

⁴Department of Biotechnology, Ch. Devi Lal University, Sirsa - 125 055 (HR) India

Received for publication: April 17, 2014; **Accepted:** June 11, 2014

Abstract: Himalayan ecosystem is known for its unique climate and plants wealth but the indiscriminate use of plant resources and increasing human interventions increases serious threat to their survival. The present study provides the information on the distribution patterns and traditional uses of medicinal plant species in the high-altitude (3298 m asl) cold desert of India in Himachal Himalayas. The people still depend upon household and traditional uses for remedies and health care. In this survey a total of 27 important medicinal plant species belonging to 15 families were recorded in grassland under Seabuckthorn community. Based upon importance value index, *Eragrostis minor* (44.30), *Equisetum arvense* (15.28) and *Chaerophyllum villosum* (8.41) showed its dominance in the grassland habitat. The Diversity Index (H') was highest in case of *Eragrostis minor* (0.37), *Carex setosa* (0.29) and *Astragalus grahamianus* (0.12). The value of Concentration dominance (Cd) was found to be highest in *Eragrostis minor*, *Equisetum arvense* and *Carex setosa*. This study provides a framework for making the effective implementation of conservation strategies in the Himalayan region.

Key Words: Cold desert, Diversity index, Himalayan region, Medicinal plant, Seabuckthorn

Introduction

The Lahaul, a region of district Lahaul-Spiti, situated at 31° 44' 57"- 32° 59' 57"N, 76° 46' 29"-78° 41' 34"E with total area of 6244 sq. km is part of the proposed Cold Desert Biosphere Reserve of Himachal Pradesh.

Climatic features

The climate of the valley varies from dry, temperate to alpine types. The area remains snow covered almost for six months and receives average snowfall 120-400 cm/year with average rainfall 10-300 mm/year. The temperature decreases to between -19°-32°C during winter (DOA, 2009).

Soil features

In general, the soil of the zone is sandy loam in texture, neutral to alkaline in reaction and low in fertility. But soils in some part are loam to clay-loam with abundance and rich in fertility. The water holding capacity also varies from poor to medium.

The soils are prone to erosion due to cultivation on steep slopes, high speed wind during summer, splashing floods, flow irrigation and overgrazing (DOA, 2009).

Vegetation features

The flora in the Indian Himalayan Region (IHR) includes about 8,000 species of angiosperm (40% endemic), 44 per cent species of gymnosperm (16% endemic), 600 species of pteridophytes (25% endemic), 1,737 species of bryophytes (33% endemic), 1,159 species of lichen (11% endemic) and 6,900 species of fungi (27% endemic) (Singh and Hajra 1996; Samant *et al.*, 1998). Seabuckthorn is the one of most important plant species belongs to family Elaeagnaceae has the ability to fix atmospheric nitrogen (Andrreeva *et al.*, 1982).

With gradually worsening environmental conditions of Himalayan region, Seabuckthorn has attracted a great

*Corresponding Author:

Suresh Kumar,
Department of Biotechnology,
Ch. Devi Lal University,
Sirsa - 125 055, HR, India.

deal of attention from the scientific and policy maker to add this plant in ecological restoration and conserving plant diversity. So, this study assesses the potential of Seabuckthorn to provide the suitable condition with its associated species in agricultural grassland.

Materials and Methods

Data Collection

Geographical study was conducted in all the representative sites in the Lahaul region. First of all, species of *Hippophae* sp. was identified on the basis of morphological characters. In each sampling site, plot of area 50×50 m² was selected, within which 10 quadrates of size 10×10 m² for tree species, 10 quadrate of size 5×5 m² shrub species and 20 quadrates of size 1×1 m² for herb species were selected for phytosociological studies. The identification of species was carried out with the help of standard available floras and research papers of the area (Chowdhary and Wadhwa 1984; Polunin and Stainton 1984; Aswal and Mehrotra 1994; Murti 2001). The parameters were calculated, were as follows:

Density and abundance

After counting the number of species, following formula was used to get the density and abundance.

$$\text{Density (D)} = \frac{\text{Total number of individuals}}{\text{Number of quadrates studied}}$$

$$\text{Abundance (A)} = \frac{\text{Total number of individuals}}{\text{Number of quadrates of occurrence}}$$

Importance Value Index (IVI)

Importance value index was calculated using the following equation:

For tree species:

Importance Value Index (IVI)

$$= \text{Relative frequency (RF)} + \text{Relative density (RD)} + \text{Relative basal area (RBA)}$$

For shrub and herb species:

$$\text{Importance Value Index (IVI)} = \text{Relative frequency (RF)} + \text{Relative density (RD)}$$

Species diversity (H')

Species diversity was determined by using Shannon and Wiener's information statistics (Shannon and Wiener, 1963) as:

$$H' = -\sum (n_i/n) \times \ln(n_i/n)$$

Where, n_i is individual density of a species and n is the total density of all the species.

Concentration of dominance (Cd)

Simpson's diversity was calculated as follows:

$$\text{Simpson Diversity Index (D)} = \frac{\sum n(n-1)}{N(N-1)}$$

Where N = the total number of individuals of all species and n = the total number of individuals of a particular species

Results and Discussion

In this survey a total of 27 important medicinal plant species belonging to 15 families were recorded in grassland under Seabuckthorn community at 3298 m asl altitude in Khanksar village. Some of the plant species were shown in figure 1. Asteraceae and Poaceae were the dominant family in grassland habitat (Table 1). Based upon Importance Value Index, *Eragrostis minor* (44.30), *Equisetum arvense* (15.28) and *Chaerophyllum villosum* (8.41) showed its dominance in the grassland habitat. The Diversity Index (H') was highest in case of *Eragrostis minor* (0.37), *Carex setosa* (0.29) and *Astragalus grahamianus* (0.12). The value of Concentration Dominance (CD) was found to be highest in *Eragrostis minor*, *Equisetum arvense* and *Carex setosa*. Seabuckthorn found to have the Importance Value Index and Concentration dominance (Cd) that is 280.36 and 0.97 respectively (Table 2).

Table 1: Dominant families and genera under *Hippophae* sp. in Chandra

Families	Genera	Species
Asteraceae	5	5
Poaceae	3	4
Fabaceae	3	3
Apiaceae	3	3

Hippophae salicifolia was found relatively higher density and distributed along the margins of agricultural fields, grasslands and along the streams in the watershed. It has a nitrogen fixing ability through microbial association helps in land restoration (Rongsen 1992). In shrubs species, *Rosa webbiana* was dominant. It was widely distributed in the agriculture grassland, waste land and bouldary habitat except on stony outcrops and snowbound areas. *Hippophae salicifolia* and *Rosa webbiana* hold soil, checks soil

erosion and survive under extreme climatic conditions of the cold desert. *Hippophae rhamnoides* was used as fuel, making agricultural implements and the fruits are used for juice and ketchup. *Rosa webbiana* used as a fencing material and fuel. Regular irrigation through kuhl promotes natural regeneration of local species under agroforestry and forestry systems. This was evident in reflecting the species richness, evenness and diversity index of the

agroforestry and forestry as compared to forest. This study supported the other report recorded high species richness (4 to 22) and diversity (0.74 to 3.10) for the shrub layer in the Kumaun Himalaya (Saxena and Singh 1982). Species diversity was under agroforestry and forest systems are comparable with values generally reported for temperate forests (Monk 1967; Singh and Singh 1987).

Table 2: Distribution of plant species in Chandra valley under Seabuckthorn community

Family/Taxa	Density (D)	Frequency (F)	Abundance (A)	Importance Value Index (IVI)	Diversity indices (H')	Concentration dominance (Cd)
Tree						
Elaeagnaceae						
<i>Hippophae salicifolia</i>	6.8	100	6.8	280.36	0.014	0.971
Salicaceae						
<i>Salix fragilis</i>	0.1	10	1	19.631	0.061	0.0002
Shrub						
Rosaceae						
<i>Rosa webbiana</i>	0.1	10	1	300	0	1
Herbs						
Apiaceae						
<i>Bupleurum falcatum</i>	1.2	30	4	6.722	0.077	0.0003
<i>Carum carvi</i>	2.25	15	15	6.0574	0.121	0.0013
<i>Chaerophyllum villosum</i>	1.75	35	5	8.415	0.102	0.0008
Asteraceae						
<i>Artemisia dracunculus</i>	4.4	20	4	6.76	0.120	0.001
<i>Aster flaccidus</i>	0.1	5	2	0.957	0.010	2.67E-06
<i>Senecio laetuis</i>	0.4	0.4	20	3.828	0.032	4.27E-05
<i>Taraxacum officinale</i>	0.4	20	2	3.828	0.032	4.27E-05
<i>Cirsium wallichii glochidiatum</i>	0.45	15	3	3.116	0.036	5.4E-05
Brassicaceae						
<i>Capsella bursa-pastoris</i>	0.7	10	7	2.731	0.051	0.0001
Caryophyllaceae						
<i>Silene edgeworthii</i>	1.05	35	35	7.271	0.070	0.0002
Cyperaceae						
<i>Carex setosa</i>	10.2	85	12	30.158	0.299	0.0278
Equisetaceae						
<i>Equisetum arvense</i>	5.95	35	17	15.278	0.227	0.0094
Fabaceae						
<i>Astragalus grahamianus</i>	2.3	15	15	6.057	0.121	0.001
<i>Heracleum candicans</i>	0.8	20	4	4.482	0.057	0.0001
<i>Trifolium pretense</i>	1.05	20	5.25	4.890	0.069	0.0002
Juncaceae						
<i>Juncus himalensis</i>	1.7	10	17	4.365	0.099	0.0007
Lamiaceae						
<i>Nepeta eriostachya</i>	0.4	20	2	3.828	0.033	4.27E-05
<i>Polygonatum cirrhifolium</i>	0.45	15	3	3.116	0.036	5.41E-05
Poaceae						
<i>Avena fatua</i>	3.1	65	17	15.30	0.204	0.0009
<i>Avena steralis</i>	1.5	15	15	4.832	0.091	0.0006
<i>Eragrostis minor</i>	20.8	65	32	44.304	0.367	0.1155
<i>Phacelurus speciosus</i>	0.1	5	2	0.957	0.010	2.67E-06
Polygonaceae						
<i>Rumex nepalensis</i>	1.05	1.05	35	7.271	0.070	0.0002
Rubiaceae						
<i>Galium asperifolium</i>	1.5	25	6	6.419	0.091	0.0006



Figure 1: Plant species associated with *Hippophae* sp. in Chandra valley

Conclusion

Mountain ecosystems are most susceptible to human impact. They need conservation and ecological restoration. Seabuckthorn is one of the most important plant species which is not only showed its importance in the waste land, riversides and sloppy area. But also found to have positive effects in grasslands. It is proposed that this plant helps in the luxurious growth of a variety of grasses under it. But this plant species is overexploited by native people. So there is an immediate need to launch a nationwide awareness campaign about the under-utilized potential of Seabuckthorn. Since majority of the local inhabitants is dependent upon the biodiversity component for their survival. Species richness and diversity was found to be quite higher when compared with other field survey in this area. Therefore, Seabuckthorn does not only show its importance in providing socioeconomic profits to poor people, but also provided suitable habitats for the flora. Due to all these services and improving the quality of life to

local inhabitants, this plant is known as Himalayan nature's *Sanjeevani*. Furthermore, rural livelihoods of the local inhabitants can be enhanced by engaging them in conserving and managing the natural resources of the Himalayas.

References

1. Andreeva IN, Fedrova EE, IIZyasova VB, Tibilov AA, Ultrastructure of nitrogen-fixing and wintering nodules in one-year seedlings of Seabuckthorn, *Hippophae rhamanoides* and oleaster, *Elaeagnus argentea*. Soviet plant phsiol, 1982, 29, 109-116.
2. Aswal BS, Mehrotra BN, Flora of Lahaul-Spiti (a cold desert in North-West Himalaya). Bishen Singh and Mahendra Pal Singh, Dehradun, India, 1994.
3. Chowdhary HJ, Wadhwa BM, Flora of Himachal Pradesh Analysis 1. Published by the Director, Botanical Survey of India, Howrah, 1984.
4. Department of Agriculture, District Agriculture Plan: Lahaul-Spiti, Himachal Pradesh, 2009, 7, 8-9.
5. Monk CD, Tree species diversity in the eastern deciduous forest with particular references to North Central Florida. American Naturalist, 1967, 10, 173-187.
6. Murti SK, Flora of Cold Deserts of Western Himalaya. Vol. I. Monocotyledons. Botanical survey of India, Calcutta, India, 2001, 8, 452.
7. Polunin O, Stainton A, Flowers of the Himalaya. Oxford University Press, Oxford, India, 1984.
8. Rongsen L, Seabuckthorn: a multipurpose plant species for fragile mountains. International Centre for integrated mountain development (ICIMOD), Occasional Paper No. 20, Kathmandu, Nepal, 1992, 1-62.
9. Samant SS, Dhar U, Rawal RS, Biodiversity status of a protected area in West Himalaya: Ashok wildlife sanctuary. Int J Susta Develop W Ecol, 1998, 5 (3), 194-203.
10. Saxena AK, Singh JS, A phytosociological analysis of woody species in forest communities of a part of Kumaun Himalaya. Vegetation, 1982, 50, 3-32.
11. Shannon CE, Wiener W, The Mathematical Theory of Communication. University of Illinois press, Urbana, Illinois, USA, 1963.
12. Singh DK, Hajra PK, Floristic Diversity Status in the Himalaya. British Council, New Delhi, India, 1996, 23-38.
13. Singh JS, Singh SP, Forest vegetation of the Himalaya. Botanical Review, 1987, 52, 82-192.

Source of support: Nil

Conflict of interest: None Declared