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FLORISTIC DIVERSITY OF CHANDRA TAL: A HIGH ALTITUDE RAMSAR WETLAND IN TRANS HIMALAYA, INDIA

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ABSTRACT

Chandra Tal is a sacred High AltiutudeRamsar Wetland located in Lahaul – Spiti district, Himachal Pradesh at the altitude of 4300m asl. A total of 75 plant species belonging to 61 genera and 21 families recorded from the Chandra Tal. Among angiosperms, dicots and monocots represented by 63 and 11 species and only one species namely Ephedra intermedia belongs to Gymnosperm respectively. While analyzing the representation of family, Asteraceae is the largest with 12 species and 80% of the total flora are belonging to eleven dominant families. A total of 32 species (in 29 genera and 16 families) are used for different ailments. Considering threat categorization of plants, six species namely, Aconitum violaceum (VU), Ephedra intermedia (LC), Phleumalpinum(LC), Poaannua (LC),Rhodiolaheterodonta(VU)and Veronica beccabunga (LC)are listed in different threat categories in IUCN andCAMP for wild medicinalplantsinHimachalPradesh. The populations of such threatened plants are facing stress both from anthropogenic and climatic perturbations. Measures like, controlling of livestock grazing around the wetland area, cultivation of threatened high value medicinal plants in nearby villages, reduce the collection from wild natural population, monitoring of threatened species population, adventure and nature based tourism in the area can be suggested to conserve the plant diversity of the wetland.

Keywords: Chandra Tal, High Altitude Wetland,Ramsar Site, Indian Trans Himalay

INTRODUCTION

High Altitude Wetlands (HAWs) of Trans Himalaya acts as a unique ecosystem that fulfils great importance for the endemic / threatened species of plants, migratory birds, wild animals and for the people living in and around the region. The hydrological regime of mighty rivers acts as a buffer between glacial melt waters and outflows to smaller rivers and streams. High altitude mountain lake ecosystems play an important role as water sources for communities at lower altitude and

sustain a degree of biodiversity (Boggero*et al.*, 2002). The Chandra Tal, is such a high-altitude Trans Himalayan wetlandlies in32°28.552´ N Latitudeand 77°37.054´ E Longitude in the rain-shadow area of Spiti Sub-division of Lahaul – Spiti district, Himachal Pradesh at an altitude of 4300m asl. The crescent shaped lake is formed by damming of glaciers (GSI, 2012) and the source of river Chandra. Being a Ramsar site (w.e.f. 2002), it has International Importance as well as a popular destination for campers and trekkers. This lake is approached from 12 km away from Batal and Kunzam pass in the Himachal Pradesh State (Singh *etal*., 2016).

MATERIALS AND METHODS

Extensive and intensive floristic survey was undertaken during July-August, 2016 to assess and document the species diversity of the flowering plants in the wetland area. Specific details of locations (Altitude, Latitude and Longitude) were recorded using hand held Global Positioning System.For analyzing the population of threatened plants, random quadrate method(Misra, 1968; Mueller-Dombois and Ellenberg, 1974) was employed and a total of 120 quadrates (1 x 1 m^2) were randomly laid in the study area. Individuals of all the species were recorded in all quadrates. Data extraction and analysis were done in MS-Excel using established techniques.

The plant species were identified by consulting different floras of the Himachal Pradesh (Aswal&Mehrotra, 1994; Chandra Sekar & Srivastava, 2009) and confirmed with authentic herbarium specimens housed in Botanical Survey of India, Dehradun (BSD).All the specimens were deposited in the herbarium of G.B. Pant National Institute of Himalayan Environment & Sustainable Development, Almora (GBP). The information of ethno-medicinal properties of the collected plants were recorded in the field with the help of local informants or 'Amchis' and thoroughly checked with the available literature pertaining to Trans Himalaya (Jain, 1991; Jain & Srivastava, 1999; Kala, 2003).

RESULTS AND DISCUSSION

The Floristic exploration reveals a total of 75 plant species belonging to 61 genera and 21 families from Chandra Tal wetland area and among them only one species namely *Ephedra intermedia* belongs to Gymnosperm. In angiosperms, dicots and monocots are represented by 63 and 11 species respectively (Figure 1). Asteraceae is the largest family represented by 12 species followed by Poaceae (8), Ranunculaceae (5), Caryophyllaceae (5), Fabaceae (5), Rosaceae (5), Gentianaceae (5), Polygonaceae (5), Scrophulariaceae (4), Geraniaceae (3) andLamiaceae (3). Eighty percent of the total flora are belonging to these eleven dominant families (Figure 2). While analyzing the diversity of ethno-medicinal

plants in the wetland, a total of 32 species(in 29 genera and 15 families) are used for different ailmentsand enumerated systematically (Table 1). Leaf parts are used maximum in number for ethnomedicinal uses (Figure 3).

Considering threat categorization of plants, six species namely, *Aconitum violaceum, Ephedra intermedia, Phleumalpinum, Poaannua, Rhodiolaheterodonta*and *Veronica beccabunga*are listed in different threat categories in International Union for Conservation of Nature (IUCN, 2015) and **Conservation Assessment** and Management Prioritisation (**CAMP, 2003)** for wild**medicinal plants in Himachal Pradesh**.*Aconitum violaceum* and *Rhodiolaheterodonta*are considered as Vulnerable (VU) and *Ephedra intermedia, Phleumalpinum, Poaannua, Veronica beccabunga*are reported as Least Concern (LC). where *Aconitum violaceum* w**as found in minimum density and** *Veronica beccabunga***found in maximum density**(Table 2)**.**

CONCLUSION

Wetlands are among the most threatened ecosystems in the world (Millennium Ecosystem Assessment, 2005). In India, these wetlands are among the least protected ecosystems, and fast disappearing at a rate of 2% to 3% every year (Anonymous, 2009; Singh and Moirangleima, 2009). In Trans Himalaya, most of wetlands are under tremendous pressure because of increasing population and unregulated development activities. Many plants as well as the animals (Fishes, migratory birds, etc.) of high altitude region are wetland dependent andthere is limited information about the biodiversity of these wetlands.

Keeping the above, the Floristic studies on Chandra Tal wetland was carried out and a total of 75 plant species were recorded. Among these plants, eight present are in threatened category and more than forty two percent are utilized for different medicinal purposes. The tabulated medicinal plants were collected by local people for various diseases like asthma, jaundice, malaria, fever, diarrhoea, skin diseases, etc. Such useful plants may also alternative life saving drugs in the remote areas. The medicinal uses of these plants also give clues to various pharmaceutical industries and research organizations engaged in biological screening programs on plant products for extractingactive compounds for developing new drug molecules. Apart from the use value,the following important measures can be suggested to conserve the plant diversity of the wetland: (i) control in livestock grazing in and around the wetland area, (ii) popularizing cultivation of threatened high value medicinal plants in nearby villages for medicinal usage and reduce the collection from wild natural population, (iii) promote monitoring of threatened species population, (iv) promote adventure and nature based tourism in the area. It is necessary to

monitor such fragile aquatic ecosystem to prevent extinct by anthropogenic activities coupled with climatic changes in Trans Himalaya.

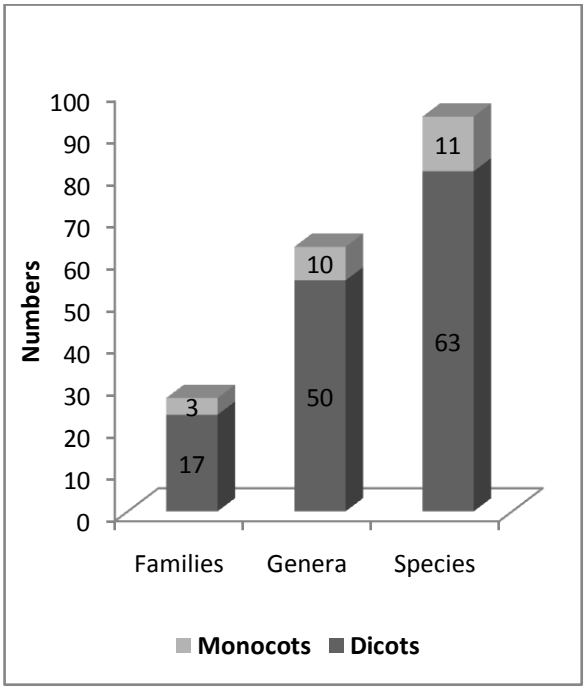

Figure 1**.** Floristic Diversity

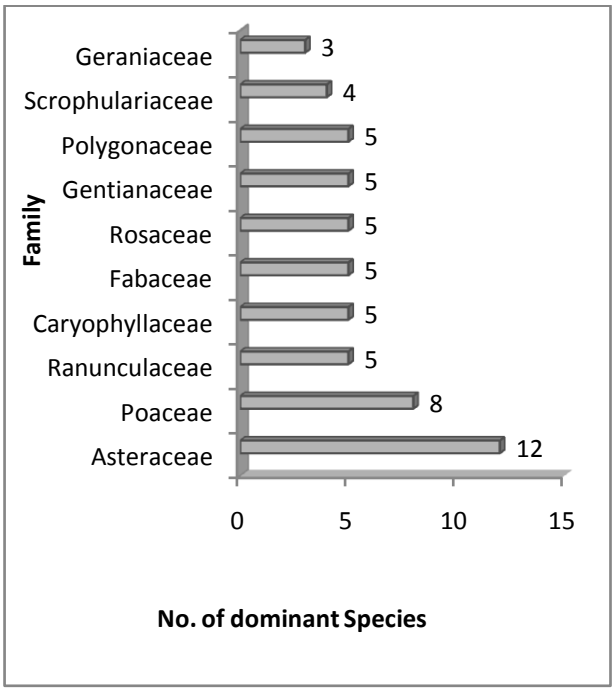

Figure 2. Dominant Families

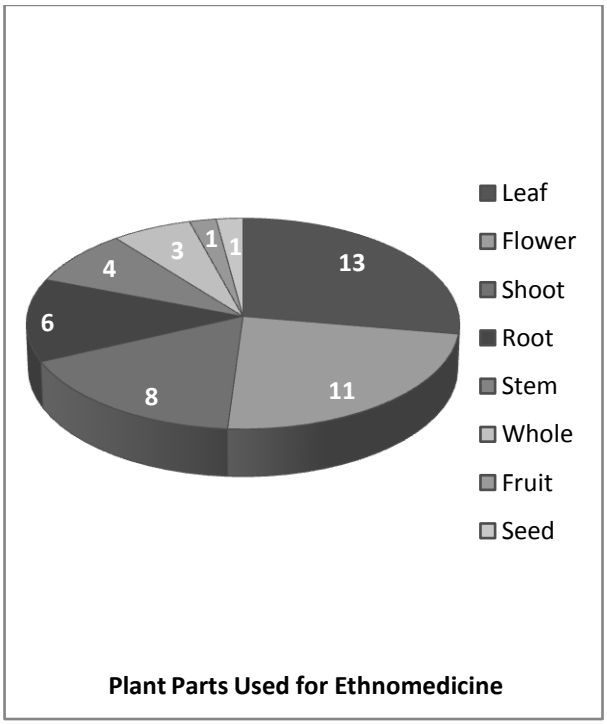

Figure 3**.** Different plant parts used for ethno-medicine

Table 1. List of medicinal plants recorded from Chandra Tal

Name of the Species	**Family**	**Local Name**	**Fl. & Fr.**	**Parts Used**	**Medicinal uses**
*Aconitum violaceum*Jacq. *ex*stapf	Ranunculaceae	*Yangtso, Zinba, Dusi-lama*	June-Sept	Root	Cough
*Anaphaliscuneifoli*a HK. f.	Asteraceae	*Simula*	July-Aug	Leaf, shoot	Wounds, skin diseases
Arabidopsis wallichii (Hk. f. & Th.) N. Busch.	Brassicaceae	-	June-Aug	Flower, leaf	Throat sores
Aster flaccidus Bunge	Asteraceae	*Lugmigchu nwa*	July-Sept	Leaf, flower	Pulmonary infections, fever
Astragalusrhizanthus Royle*ex* Benth	Fabaceae	*Sarma*	July-Sept	Shoot	Skin diseases
Bistortaaffinis (D.Don) Greene	Polygonaceae	*Langna, Chunru*	July-Sept	Flower	Cold, diarrhoea
*Carexnigerrima*Nelmes	Cyperaceae	-	July-Sept	Shoot	Wounds
Cerastiumcerastoides (L.) Britton	Caryophyllaceae	*Spangianka rpo*	June-Sept	Shoot	Cough
*Delphinium cashmerianum*Royle	Ranunculaceae	*Lunde-kaown, Cha-gotpa*	July-Sept	Seed, shoot, flower	Throat-ache

Ephedra intermedia Schrenk et Meyer	Ephedraceae	*Tse*	June-Sept	Stem, root	Asthma, fever
Erigeron multiradiatus(Lindl. *ex* DC.) Benth. *ex* C.B. Clarke	Asteraceae	-	June-Sept	Whole Plant	Stomach pain
*Euphrasiahim*alaicaWettst.	Scrophulariaceae	-	July-Aug	Leaf	Eye complaints
Gentianella moorcroftiana (Wall. *ex* G. Don) Airy Shaw	Gentianaceae	*Teekta*	July-Sept	Leaf, flower	Fever, headache, jaundice, acidity
*Gentianell*a *paludosa*(Munro *ex* Hook. f.) Harry Sm.	Gentianaceae	*Pallutso*	July-Sept	Root	Tonic
Geranium pratense L.	Geraniaceae	*Gagchukwong-po*	July-Sept	Leaf, flower	Diarrhoea, headache
*Geranium wallichianum*D.Don*ex* Sweet	Geraniaceae	-	July-Sept	Root	Eye complaints
Halerpestestricuspis (Maxim) Hand.- Mazz	Ranunculaceae	*Sharchang*	June-Aug	Shoot	Toothache
Nepeta thomsoniiBenth. ex Hk. f.	Lamiaceae	*Neimlo*	June-Aug	Leaf	Dysentery
Oxyriadigyna (L.) Hill	Polygonaceae	*Chur-tse, Chum-tse*	June-Oct	Flower	Diarrhoea
Oxytropislapponica (Wahl.) Gay.	Fabaceae	-	June-Aug	Shoot	Joint pain
*Pedicularislongiflor*a Rud.	Scrophulariaceae	*Phakchang, Lungrizarpo*	July-Aug	Leaf, stem	Wounds
Pedicularispectinata Wallich*ex*Benth.	Scrophulariaceae	*Lungrimup po*	June-Aug	Flower	Fever
Polygonum viviparum L.	Polygonaceae	*Naram, Langangpa*	June-Sept	Root	Diarrhoea
*Potentillaatrosanguinea*Lodd. *ex*Lehm	Rosaceae	*Chisheng*	July-Aug	Whole plant	Fever, wound
Ranunculus laetus Wall. *ex* D. Don	Ranunculaceae	*Sharchang*	July-Sept	Leaf	Tonic
*Rhodiolaheterodont*a (Hk. f. & Th.) Boriss.	Crassulaceae	*Sholo-marpo*	June-Aug	Shoot	Cough
*Saxifragaflagellaris*Willd. *ex*Sternb.	Saxifragaceae	*Suchutlikh*	July-Sept	Leaf, flower, stem	Fever, jaundice
Silenemoorcroftiana W*all. ex* Benth.	Caryophyllaceae	*Timuksa, Lugsuk, Shukoa*	June-Sept	Flower, leaf, fruit	Fever
Tanacetumdolichophy	Asteraceae	*Semigmanl*	July-Sept	Leaf, flower	Intestinal worms

llum (Kitam) Kitam		*o*			
Taraxacumofficinale Weber	Asteraceae	*Han*	June-Oct	Root, stem	Tonic, mouth blisters
*Thymus linearis*Benth.	Lamiaceae	*Taksha, nakpo*	June-Sept	Whole plant	Tonic
*Youngiaglauca*Edgew	Asteraceae	*Remang*	June-Aug	Leaf	Muscle pain

Table 2. Status and population density (individuals/m^2) of threatened plants of Chandra Tal

Species	Density (individuals/m^2)	Threat Category
*Aconitum violaceum*Jacq. *ex*stapf	0.1	VU
Ephedra intermedia Schrenk*et* Meyer	0.2	LC
Phleumalpinum L.	0.9	LC
Poaannua L.	0.6	LC
Rhodiolaheterodonta (Hk. f. & Th.) Boriss.	0.4	VU
Veronica beccabunga L.	1.5	LC

VU – Vulnarable, LC – Least Concern

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