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DIVERSITY AND CONSERVATION STATUS OF ORCHIDS IN AND AROUND PRASHAR SACRED SHRINE IN HIMACHAL PRADESH, INDIA

Sunil Marpa and S S Samant

G.B. Pant Institute of Himalayan Environment and Development, Himachal Unit, Mohal-Kullu- 175 126, Himachal Pradesh, India

Abstract

While exploring the floristic diversity of Prashar Sacred Shrine, a total of 16 species of the orchids representing 13 genera were recorded. These species were distributed between 1800-3000m amsl and grew in forests, alpine meadows/thatches and riverine habitats. They were analysed for nativity, endemism and rarity besides their indigenous uses. Ten species are native, six non-native, and one near endemic. Some of them find utility as aphrodisiacs, tonics, appetizers, blood purifiers, and in curing a variety of diseases. Four species are critically endangered, 4 endangered, 6 vulnerable, and 2 near threatened. Habitat degradation, over exploitation and changing environmental conditions have detrimentally affected the natural orchid population. Several measures have been suggested for their conservation and management.

Introduction

HIMACHAL PRADESH forms a part of Trans and North-Western Himalayan bio-geographic provinces of the Indian Himalayan Region (IHR). The vegetation ranges from tropical, sub-tropical, temperate, and sub-alpine to alpine. The unique topography, vast altitudinal range (200-8000 m), and diverse habitats support a large variety of flora and fauna. Over 3,200 species of flowering plants are estimated, of which 643 species have medicinal importance (Samant *et al*., 2007).

Although the state is lesser known for orchid diversity, it supports natural, unique and socio-economically important orchids (Chauhan, 1999; Deva and Naithani, 1986; Samant, 2002). The orchids have attracted several investigations (Deva and Naithani,1986; Samant, 2002; Rana and Samant, 2010; Vij *et al*., 1982) Systematic studies have also been done by various workers while exploring and writing the flora (Aswal and Mehrotra, 1994; Chowdhary and Wadhwa, 1984; Collet, 1902; Dhaliwal and Sharma, 1999; Kaur and Sharma, 2004; Singh and Rawat, 2000). Inventories of the orchids have also been made by various workers while exploring the floristic diversity of the protected and unprotected areas (Lal, 2007; Rana, 2007; Sakshi, 2009; Samant *et.al*., 2007, 2010; Sharma, 2008; Singh, 2007. However, focused studies on orchids have been very rarely attempted (Rana and Samant, 2010; Samant, 2002). The state which is known as "Dev Bhoomi", has a large number of Sacred Shrines, none of which has been explored for their floristic diversity. Presently an attempt has been made to study the diversity and distribution of orchids in Prashar Sacred Shrine. The aim has been to analyse their nativity, endemism and rarity, identify their socio-economic values, and to develop appropriate strategy for their conservation.

Material and Methods

Study Area

The Prashar sacred shrine is located between (31° 45' 09" - 31° 46' 51" N latitudes and 77° 02' 59" - 77° 06' 52" E longitudes) in Mandi District of Himachal Pradesh (Fig.1). The altitude ranges from 1800-3000m amsl. The climate is temperate and sub-alpine with three distinct seasons, winter (November-March), summer (April-June) and rains (July-September). It is warm during summer when the maximum temperature goes upto 30°C, winters are freezing and snowfall usualiy occurs during December to March. The temperature ranges between -10°C to 30°C and mean annual rainfall is 1200 mm (Source: Forest Department Mandi, Himachal Pradesh).

The vegetation comprises temperate and sub-alpine types. The temperate vegetation is mainly dominated by coniferous and broad leaved species namely *Cedrus deodara*, *Pinus wallichiana*, *Quercus floribunda*, *Q. leucotrichophora*, etc., whereas sub-alpine vegetation is dominated by *Quercus semecarpifolia*, *Pinus wallichiana*, *Picea smithiana*, and *Abies pindrow*. The forests support a large number of algae, fungi, lichens, bryophytes, pteridophytes, and angiosperms, and provide congenial habitats for the growth and development of ground orchids, most of which are shade, moisture and humus loving. The Prashar Sacred Shrine is surrounded by a large number of villages and the inhabitants are largely dependent on these forests for their sustenance. But due to over exploitation, and habitat degradation, the natural orchid populations are declining rapidly. Attempts have remained elusive to explore the orchid vegetation

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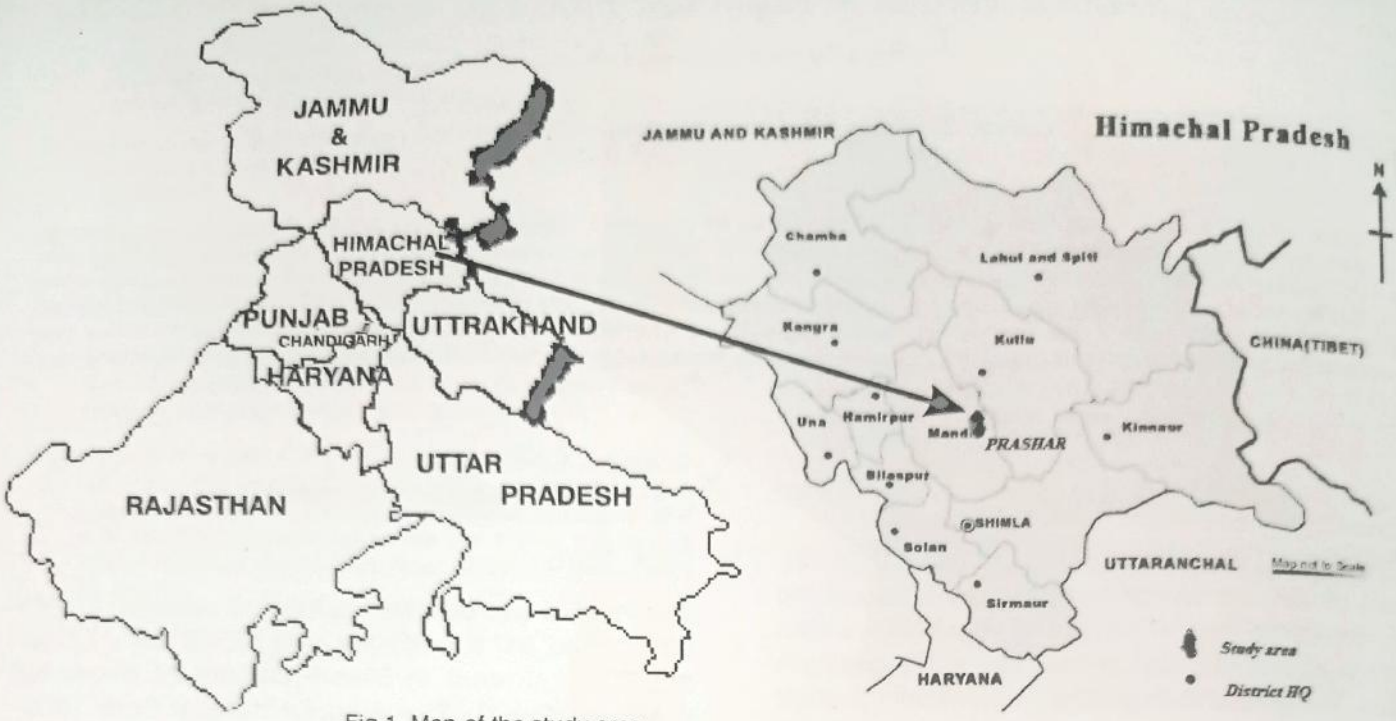

Fig.1. Map of the study area

in the sacred shrines of Himachal Pradesh.

Assessment, Sampling, Identification and Data Analysis

Extensive field surveys were conducted to study the orchid diversity in Prashar Sacred Shrine. The rapid sampling of species was done. The samples of each species were collected and brought to the Institute for identification using local (Aswal and Mehrotra, 1994; Dhaliwal and Sharma, 1999; Singh and Rawat, 2000) and regional (Deva and Naithani, 1986, Pangtey *et al.*, 1991) floras. Local people were also interviewed to record the ethno-botanical importance of different species. Data on species diversity, distribution pattern, nativity, endemism and rarity was analyzed. Nativity of the species was identified following Anonymous (1883-1970),Samant (2002, 2009); Samant *et al.* (1998 a, b). Endemic status of the species is based on their biogeographical distribution (Dhar and Samant, 1993; Samant, 2002, 2009). The species restricted to IHR were identified as endemic where as those extending their distribution to neighboring countries such as Nepal, Bhutan, Tibet, Pakistan and Afghanistan were identified as near endemic (Samant, 2002). Habitat preference, population size, distribution range, and use values were collectively used to assess the status of a particular species (Samant *et al.*, 1995; Rana and Samant, 2010). Orchid habitats were identified on the basis of physical features. A site with a closed canopy and high humus and moisture content was designated as moist habitat and that with low humus and moisture content as dry habitat. Indigenous uses of the species are based on the interviews of local inhabitant and available information (Chauhan, 1999; Jain, 1991; Samant *et al.*, 1998a, 2007).

Results

Species Diversity and Distribution Pattern

A total of 16 species of orchids belonging to 13 genera were recorded. (Table 1). *Calanthe* (2 spp.), *Goodyera* (2 spp.), and *Herminium* (2 spp.) represented the maximum diversity. Ten genera namely *Cephalanthera*, *Dactylorhiza*, *Epipogium*, *Galeola*, *Gostrodia*, *Habenaria*, *Listera*, *Malaxis*, *Satyrium* and *Spiranthes* were represented by a single species each.

All the species were distributed in temperate zone (1800-2800 m). However, above 2800 m, 9 species namely, *Calanthe tricarinata*, *Dactylohiza hatagirea*, *Epipogium tuberosum*, *Goodyera repens*, *Gastrodia orobanchoides*, *Habenaria edgeworthii*, *Herminium monorchis*, *Listera tenuis* and *Malaxis muscifera* were recorded.

Nativity and Endemism

The diversity of the native, non-native and near endemic species is presented in Fig.2. *Calanthe plantaginea*, *C. tricarinata*, *Dactylorhiza hatagirea*, *Epipogium*

tuberosum, Galeola lindleyana, Goodyera biflora, Gostrodia orobanchoides, Habenaria edgeworthii, Herminium monopyllum and *Listera tenuis* are native to the Himalayan region. Six species namely, *Cephalanthera longifolia, Goodyera repens, Herminium monorchis, Malaxis muscifera, Satyrium nepalense* and *Spiranthes sinensis* are non-natives, and only *Dactylorhiza hatagirea* near endemic to the IHR.

Threats to Orchid Diversity

From among the present species, four were categorized as critically endangered, 4 as endangered, 6 as vulnerable, and 2 as near threatened (Table 1). Incidentally, *Dactylorhiza hatagirea* and *Malaxis*

Table1. Diversity, distribution, indigenous uses and status of Orchids in and around the Prashar Sacred Shrine Himachal Pradesh.

Taxa	Altitude (m)	Habitat	Nativity	Status	Part/s used	Indigenous uses and practices
Calanthe plantaginea Lindl.	1800-2800	1,2	Reg Himal	E	-	Ornamental
Calanthe tricarinata Lindl.	2200-3000	1,4	Reg Himal	CR	Lf, Bb	Decoction of the leaves and bulbs is used in sores, eczema and as aphrodisiac.
Cephalanthera longifolia Linn.	1950-2500	1,3	Europe, Afr, Bor, As, Temp	NT	Tb	Decoction of the tubers is given in cough and paralysis and also used as aphrodisiac, tonic.
Dactylorhiza hatagirea D. Don	2800-3000	5,9,10	Reg Himal, Europe, Afr Bor, Orient	CR	Tb	Antibiotic, blood purifier and tonic, expectorant and in wound healing, bone fracture, cough, cold, cuts, sexual disability, rheumatism
Epipogium tuberosum Duthie	2800-3000	4	Reg Himal	E	-	-
Galeola lindleyana (Hk.f. & Thorn.) Reichb.f.	1800-2050	1,4	Reg Himal	E	-	-
Goodyera biflora (Lindl.) Hk.f.	1900-2400	1,7	Reg Himal	V	AP	The decoction is used as appetizer, blood purifier and in cough.
G. repens (Linn.) R. Br.	2800-3000	1,2,7,9	Reg Himal, Bor, Temp	V	AP	Decoction is used as appetizer and blood purifier and for curing female disorders, syphilis, cold, and kidney problems.
Gastrodia orobanchoides (Falc.)Benth.	2600-3000	1	Reg Himal	E		-
Habenaria edgeworthii Hk.	2600-3000	2	Reg Himal	V	Tb	Blood purifier, rejuvenator
Herminium monophyllum D. Don	1800-2000	1	Reg Himal	CR	Tb	Kidney disorder
Herminium monorchis Linn.	2200-3000	1,9	Europe, As, Bor	NT	Wp	Decoction of the whole plant is given in urinary problems.
Listera tenuis Lindl.	2800-3000	1	Reg Himal	V		
Malaxis muscifera (Lindl.) Kze.	2000-3000	7,9	Europe	CR	Bb	Decoction is used as refrigerant, febrifuge, tonic, aphrodisiac and styptic for curing dysentery, debility and sterility. Paste is used in burns.
Satyrium nepalense D.Don	1900-2900	9	India, Orient	V	Tb	The decoction is used as energizing tonic, aphrodisiac and for treatment of dysentery and malaria.
Spiranthes sinensis (Pers.) Ames.	1900-2200	4	China, As, Temp	V	Tb	Decoction is used in tuberculosis, hemoptysis, debility, snake bite, sore throat, cough, leucorrhea, diabetes and pyrodermas.

Abbreviations used: CR, Critically Endangered; E, Endangered; V, Vulnerable; NT, Near Threatened; Tb, Tuber; Bb, Bulb; Wp, Whole plant; Ap; Aerial part; Lf, Leaf; Reg Himal; Himalayan Region; Bor, Boreal; Afr, Africa; As, Asia; Temp, Temperate; Orient, Oriental; 1, Shady Moist; 2, Riverine; 3,Degraded; 4, Dry; 5, Bouldary; 7, Shrubbery; 9, Moist Alpine Slope; 10, Dry Alpine Slope.

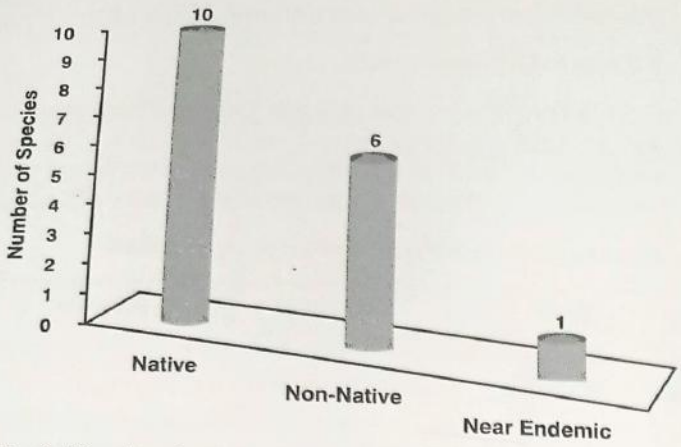

Fig. 2. Diversity of native, non-native, and near endemic orchid in Prashar Sacred Shrine Himachal Pradesh

muscifera have also been globally identified as critically endangered (Ved *et al.*, 2003).

Indigenous Uses

The inhabitants of the region use various parts of the orchid species for bone fracture, as an astringent, aphrodisiac, appetizer, blood purifier, expectorant, tonic, healing cuts and wounds, curing cough, paralysis, dysentery, malaria, sores, eczema, cold, blood purifier; kidney disorder, female disorder, syphilis, tuberculosis, hemoptysis, debility, snake bite, leucorrhea, diabetes, pyroderma and also as rejuvenating drugs (Table 1).

Discussion

The present study provides first hand information on 16 species of orchids growing in Prashar Sacred Shrine of Himachal Pradesh. In general, the systematic studies on the orchids of IHR indicate that the diversity of orchids decreases from Eastern Himalaya to the Trans, NorthWestern Himalaya (Deva and Naithani, 1986; Pangtey *et al.*, 1991). Similar trends have been also reported by studies on phytogeography and ecology of the orchids of IHR (Samant, 2002; Samant *et al.*, 1995). The temperate zone (1800-2800 m) supports 16 species indicating favorable habitat and climatic conditions for the growth and development of orchids. Occurrence of 10 native and one near endemic species in this zone indicates the naturalness and uniqueness of the orchids and high conservation importance of the area. The study shows that the diversity of the orchids decreases with the increase in altitude due probably to their requirement for specific climatic conditions (Samant, 2009).

Apart from the aesthetic and decorative values, the orchids are also used in the customary system of medicine, and as food (Samant and Dhar, 1997; Samant *et al.*, 1998a). Orchids are rich in alkaloid and phytochemical contents, and many of them are used in indigenous medicines to cure a variety of human ailments. In fact, they have been used in the folk lore and other local medicines for past more than 3000 years (Handa, 1986; Lawler, 1984). Interactions and interviews with the local inhabitants of the area validate the facts that orchids are important for their multifaceted uses. Almost all plant parts (tubers, bulbs, leaves, flowers etc.) in powder form or as an extract are used in herbal medicines to cure rheumatism, bronchitis, nervous disorders, piles, inflammations and also as a potential anti-cancerous drug (Chauhan, 1990). They are rich in alkaloids, flavonoids, glycosides, carbohydrates and other phytochemical contents (Samant, 2002). Orchids provide a source of intense aesthetic pleasure with their incomprehensible range of flowers in terms of superb colour combinations. The orchid flowers exhibit an inconceivable range of diversity of size, shape, structure and fragrance, have been well established in floriculture (Samant, 2002).

Calanthe tricarinata, *Dactylorhiza hatagirea Herminium monophyllum*, and *Malaxis muscifera* have been categorized as critically endangered in the present study area, the later two species globally. This could be due to their over exploitation and habitat degradation. The above two factors coupled with changing environmental conditions have increased the degree of threats. Therefore, study on habitat ecology of the orchids, development of conventional and *in-vitro* propagation protocols, educational and awareness programme for the inhabitants on conservation and management and establishment and maintenance of orchids in the in-situ and ex-situ conditions are urgently required to maintain the gene pool of such an unique and valuable group of plants for posterity.

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