A CASE STUDY IN VALERIANA JATAMANSI: AN IMPORTANT MEDICINAL PLANT OF KASHMIR HIMALAYA

Aabid M. Rather, Irshad A.Nawchoo, Aijaz A. Wani , Aijaz H.Ganie and Bilal A. Tali

Economic Botany and Reproductive Biology Research Laboratory
Department of Botany, University of Kashmir, Srinagar-190 006. J & K. India
Corresponding author :*email: abid.bot@gmail.com ; irshadnawchoo@yahoo.co.in

ABSTRACT
Himalaya is credited all over the world as a treasure of medicinal plants. Among these medicinal plants Valeriana jatamansi (Valerianaceae) have tremendous medicinal importance. Large-scale exploitation, biotic interferences and increasing demand for Valeriana jatamansi has threatened the very existence of the species. Conservation of the species has become need of the hour. Cultivation at large scale and development of elementary agro-techniques at lower altitudes under ex-situ conditions can prove viable in terms of economy and conservation.

Key words: Valeriana jatamansi, conservation, threatened

INTRODUCTION
India is recognized one of the mega biodiversity countries of the world and nurtures enormous plant diversity. However, this plant wealth is eroding at a fast pace due to habitat loss, fragmentation, over-exploitation, invasion of exotics, pollution and climate change. The biosphere has lost some valuable species and many more are threatened. According to estimates tropical forests alone are losing one species per day. The erosion of species richness is going to erode the valuable genomes, genes, ecosystem balance, ecosystem stability and a host of other characteristics which are hard to retrieve back. The anthropogenic interferences have deflected the natural directions, posing threat and thirst to the charming ecosystems. The population explosion and economic development, the world over has been the basic and fundamental reason for the depletion of natural resources.Growing awareness of the importance of plant diversity and rapid decline of these valuable plants, have given an unprecedented impetus for their monitoring and conservation (Victor, 2010).Any conservation approach has to be based on in-depth study of plant reproductive biology, as failure of reproductive processes to cope with the environmental changes is one of the fundamental reason for species loss and various reproductive characteristics such as seed dispersal, germination capacity, survival rate of seedlings and adults, age at flowering, reproductive life span and number of flowers and seeds refer to set of responses that allow a species to adapt to a particular environment (Moza and Bhatnagar, 2007). To develop a suitable prescription and
panacea, understanding of reproductive biology, seed biology and breeding behaviour is regarded to be of nuclear importance as well as the central element (Wafai and Nawchoo, 2001). _Valeriana jatamansi_ Jones Syn. _Valeriana wallichi_ (Bennet, 1987), popularly known as Indian valerian (English), Mushkibala (Kashmiri), Suganthdhawal or Tagar (Sanskrit), (Raina and Srivastava, 1992). The species is being labeled as critically endangered due to over-exploitation of rhizomes for its medicinal value, habitat degradation and other biotic interferences in its distribution ranges. If left as such and exploited at the same rate, in near future, the species will disappear forever. Thus, convention on international trade on endangered species notified _Valeriana jatamansi_ in its schedule for conservation. Keeping in view the immense medicinal importance and critically endangered status of _Valeriana jatamansi_ it becomes necessary to study various asexual and sexual constraints if any, which in turn will prove to be helpful in planning the conservation strategies.

**MATERIAL AND METHODS**

During the present study various methods and scientific approaches were carried out in the field, laboratory and in natural habitats to understand the reproductive biology of _Valeriana jatamansi_. An extensive exploration of different Kashmir Himalayan habitats was carried out to identify specific areas across different geological conditions covering a wide range of habitats. Among various populations three sites were selected for further studies on the basis of following criteria:

- Accessibility of the site
- Habitat structure.
- Plant density

The salient features of the selected sites are depicted in Table 1.

Various populations were analyzed for plant structure, number of shoots per plant, rhizome shape and dimensions, plant height, leaf number and dimensions, flower structure and dimensions, structure of sex organs and seed size and number.

**RESULTS**

_Valeriana jatamansi_ (Valerianaceae) is perennial, critically endangered medicinal herb distributed in sub-temperate to temperate regions at an altitude gradient of 1200-3000m asl. It is commonly known as Mushkibala (Kashmiri), Tagar (Sanskrit), Indian Valerian (English) and Suganthdhawal (Tamil). Owing to its immense medicinal properties, over-exploitation of rhizome and roots for medicinal use and consequent degradation of natural habitats are major threats which the herb at present is facing. Since the species is categorized as critically endangered, it necessitates that _in situ_ as well as _ex situ_ conservation strategies.

During the present investigation the species was found sporadically distributed in the mountain ranges of Kashmir Himalayas confined to sub-temperate and temperate regions, thriving best in moist shady slopes, rocky slopes, land slide areas ranging in an altitude of 1200-3000m asl. The species was mainly found in Gulmarg, Ferozpora,
Yusmarg, Duksum, Sonamarg, Phalgam, Naranag and Dara. This species is a tufted, hairy herbaceous perennial, gynodiecious herb with hermaphrodite plants ranging from 13.0-37.70 cm in height.

Table 1 Salient features of some selected sites for studies on *Valeriana jatamansi*

<table>
<thead>
<tr>
<th>Habitat character</th>
<th>Gulmarg</th>
<th>Ferozpora</th>
<th>KUBG*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil type</td>
<td>Humus rich</td>
<td>Humus rich</td>
<td>Sandy loam</td>
</tr>
<tr>
<td>Altitude (asl)</td>
<td>2650 m</td>
<td>2150 m</td>
<td>1595m</td>
</tr>
<tr>
<td>Slope</td>
<td>Moderate to steep</td>
<td>Moderate to steep</td>
<td>Moderate</td>
</tr>
<tr>
<td>Forest range</td>
<td>Jehlum valley</td>
<td>Jehlum valley</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>forest division</td>
<td>forest division</td>
<td></td>
</tr>
<tr>
<td>Latitude/longitude</td>
<td>34º 04´/N 74º</td>
<td>34º 04´/N 74º 18´/E</td>
<td>34º 30´/N 75º</td>
</tr>
<tr>
<td>Direction with reference to Srinagar</td>
<td>North west</td>
<td>North west</td>
<td>-</td>
</tr>
<tr>
<td>Habitat</td>
<td>Shady moist slopes</td>
<td>Shady rocky slopes</td>
<td>Open, plain with partial shade</td>
</tr>
<tr>
<td>Threat factor</td>
<td>Grazing, extraction, Habitat degradation and fragmentation</td>
<td>Grazing, extraction, Habitat degradation and fragmentation</td>
<td>-</td>
</tr>
</tbody>
</table>

KUBG- Kashmir University Botanical Garden (Transplant site)

and female plants found usually dwarf than hermaphrodite with heights from 10.90-29.50cm. The plant is characterized by thick horizontal rhizome with diameter ranging from 2.0-4.40cm with 10-37 roots per stock. Basal radical leaves are long stalked, deeply cordate-ovate, usually toothed or sinuate up to 3.20-8.30cm long and 2.40-7.50cm broad. Cauline leaves are only a few, much smaller, entire or sometimes pinnate of 1.90-2.70cm in length and 1.60-2.30cm in breadth. Flowers are white or tinged with pink in terminal corymbs with 8-13 female flowers per inflorescence and 8-14 hermaphrodite flowers per inflorescence which are larger and broader than female flowers and are ranging from 0.30-0.40cm across. Calyx is represented by inwardly curved ring which opens into plumose pappus at fruit setting stage. However, corolla is five lobed with rotate, white or pinkish depending on the availability of light. Gynoecium is tricarpellary
syncarpous. ovary seemingly unilocular with single ovule, ovary inferior and seed is one seeded achene (Fig. 1).

Fig. 1. Valeriana jatamansi: (a) hermaphrodite plant in full bloom (b) female plant in flowering phase

The seeds of Valeriana jatamansi usually over-winter in resting phase, exhibiting physiological dormancy. However, few seeds as and when get dispersed by parachute mechanism at relatively immature stage do germinate immediately subjected to the availability of micro site. The seedlings of such seeds hardly survive in nature because they have to face the onslaught of chill in winter. With the onset of favourable conditions (March-April) the least percentage of dormant seeds starts to germinate accounting for meager addition to the population in terms of new recruitments. The *in vivo* seed germination was worked out in KUBG (Kashmir University Botanical Garden) to see how seeds of Valeriana jatamansi behave to different habitat conditions and to successfully investigate the effect of open conditions and dappled or partial shade on germination of seeds in natural soils. It was observed that under dappled shade the %age seed germination was remarkably on the higher side (84.7%) as against the open sun conditions wherein only 48.73% germination was registered (Fig. 2).

Fig. 2. Depicting comparative seed germination under two different condition
In vivo propagation studies reveal that rhizome cuttings of this plant (4-8 per plant) respond well to different treatments with IAA (1mM) and IBA (1mM). These chemicals were found to be most effective in increasing %age rooting and %age shooting with successful regeneration of each cutting into a new plant (Fig.3).

![Graph showing percentage survival](image)

**Fig. 3. Showing effect of different treatments on percentage survival of Valeriana jatamansi**

**DISCUSSION**

A variety of approaches both in situ and ex situ, have been proposed and implemented for conservation of plant resources but any conservation approach has to be based on in-depth study of plant reproductive biology. Reproductive characteristics such as seed dispersal, germination capacity, survival rate of seedlings and adults, age of flowering, reproductive life span and number of flowers and seeds refer to a set of responses that allow a species to adapt to a particular environment. This species was found sporadically distributed over various sites of Kashmir Himalayas which include Shajnar, Dara, Harwan, Gulmarg, Yusmarg, Ferozpur, Sonamarg and Pahalgam (Naqashi and Dar, 1982-1986). These sites experience severe climatic conditions (low temperate, extreme variability in rainfall, fast winds, frequent clouds and high cosmic fallout etc.) and are too inaccessible. This taxon has a greater endurance to extreme environments which are ecologically specific and unique in terms of habit, altitude, plant associations, edaphic conditions. Due to high demand of its rootstock, it is being extracted from wild sources that led to extinction of this precious species from its natural habitats. The seeds of Valeriana jatamansi usually over-winter in resting phase, exhibiting physiological non-deep dormancy. However, few seeds as and when get dispersed by parachute mechanism at relatively immature stage do germinate immediately subjected to the availability of favourable environment. The seedlings of such seeds hardly survive in nature because they have to face the onslaught of chill in winter. With the onset of favourable conditions (March-April) the least %age of dormant seeds starts to germinate accounting for meager addition to the population in terms of new recruitments.

In order to overcome this bottleneck, the species has established an efficient method of vegetative propagation. The vegetative reproduction is accomplished through the
underground perenating buds borne on the underground rhizome. However, in next growing season the fresh rhizomes usually produces 5-8 perenating buds, which develop into leafy shoots. Thus *Valeriana jatamansi* is adapted both to vegetative as well as sexual reproduction with the former providing stability to the genotype at a particular site and the later contributing to generation of variability through sexual recombination of genes. As the species perenniates through rhizomes which give rise to numerous flowering shoots in each flowering season, this feature not only helps the plant to establish at a location but also ensures perpetuation even in absence of seed setting (Dhami and Mahindru, 1998). However, vegetative propagules have some advantage over the seeds in that they have a tremendous head start development and growth, often mature earlier and may have better juvenile survivorship and less mortality (Amor, 1974; Abrahamson, 1980). The difference even though marginal clearly demonstrate that rhizome cuttings with an apical shoot have the capability to regenerate into new plants under ex-situ conditions. Utilizing this cost effective method of propagation, the species can be multiplied in lesser time with good survival rates. Similar kind of trend has been earlier been reported by Nautiyal *et al.* (2001)

**REFERENCES**


