

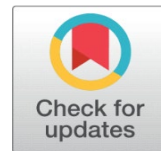
PAEONIA EMODI: A THREATENED IMPORTANT MEDICINAL PLANT OF HIGHER HIMALAYAN REGION



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ABSTRACT

Himalaya is well known for its rich biodiversity with respect to medicinal and aromatic plants and *Paeonia emodi* Wall. ex Royle is one of them locally known as Chandra (family Paeoniaceae). In India, it is distributed in North–West Himalaya from Kashmir to Garhwal-Kumaun regions of Uttarakhand with an altitudinal range of 1800 to 2800 m asl. The whole plant of *P. emodi* is highly effective for uterine diseases, blood purifier, colic, bilious, backbone ache, headache, dizziness, vomiting, dropsy, epilepsy and hysteria while the seeds are purgative. A present phytosociological study particularly in Garhwal Himalaya, reveals that only few pockets of *P. emodi* are higher dense in Triyuginarayan and Shyalmi areas (3.80 and 2.72 individual/m² respectively) while remaining are lower dense under diverse climatic conditions due to invasion by several biotic and abiotic factors. Using available information based on field survey, it assumed that the causes of its degradation are largely overexploitation of immature twigs before flower formation and seed shedding. To conserve the targeted species for future prosperity, Government needs to take immediate and concrete initiatives or imposed the ban on illegal collection or removal of the plant from its natural populations and emphasize the promotion of conservation.

Keywords: *Paeonia Emodi*, Garhwal Himalaya, Medicinal and Aromatic Plants, Phytosociological Study, Anthropogenic Pressure

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1. INTRODUCTION

Himalaya is well known for its rich biodiversity with respect to medicinal and aromatic plants. Owing to its unique geographical setup, topography and undulant landscape the climatic conditions varied along an altitudinal gradient which attributes diversified ecological habitat ranging from tropical forest, grassland to alpine meadows with vast and diverse natural resources. It supports over 675 species of wild edible plants and holds many largest and youngest mountain chains and covering an area about 2,36000 Km² Kala (2005), Malik et al. (2015). It is well said fact that numbers of plant species are threatened at different levels due to impact of climate change, urbanization, extensive agriculture and anthropogenic pressure in terms of trampling, deforestation, overexploitation as well as unsustainable harvesting Maikhuri et al. (1998), Vashistha et al. (2006), Kandari et al. (2012). Unfortunately, some of these natural resources, mostly high-altitude medicinal plants are unscientifically exploited for various purposes such as drug and pharmaceutical industries, traditional use and research purposes from their natural populations and this activity has adversely

affected the existence of numbers of high commercial valued plants. The medicinal plants are rich in secondary metabolites as well as a good source of herbal drugs. These secondary metabolites include alkaloids, glycosids, coumarins, flavonoids, steroids, etc. are varying from plants to plants in various environmental and climatic conditions [Riaz et al. \(2013\)](#). Plants which grow well in forest region, classified as minor forest products, supply a substantial amount of raw material required for the indigenous industry. Most of these plants can subsist under stress conditions and are thus suited even for rainfed cultivation of medicinal plants offering considerable scope for rural employment and export for foreign-exchange [Munir et al. \(2018\)](#).

Since mentioned anthropogenic pressure and developmental activities in the higher Himalayan region without rehabilitation work of these valuable resources, the original populations of many of them have been vanishing [Maikhuri et al. \(1998\)](#), [Nautiyal et al. \(2001\)](#), [Semwal et al. \(2007\)](#), [Chen et al. \(2013\)](#). However, in the Himalayan region number of high valued medicinal plant species is found growing and *Paeonia emodi* is one of them. Despite of having huge medicinal properties and descent income generating potential for rural peoples, it could not get much attention on conservation and cultivation particularly in areas near by its natural habitats.

Paeonia emodi Wall. ex Royle, locally known as Chandra is an important member of family Paeoniaceae, which is largely distributed in North-West India (from Kashmir to Garhwal-Kumaun regions of Uttarakhand), Northern Pakistan, East Afghanistan, China and West Nepal [De-yuan \(1997\)](#) with an altitudinal range of 1800 to 2800 m asl [Rawat et al. \(2010\)](#). The species is well flourishes in the moist and sandy to loam soil within the understory of deciduous mixed forest like Oak and Pine species [Joshi et al. \(2017\)](#). It is an erect, leafy perennial glabrous herb, 50-70 cm long with biternate or ternate, lamina pale leaves with solitary and axillary flowers. The flowering and fruiting time of the species is between May to August [Joshi et al. \(2017\)](#).

The rhizome of *P. emodi* is highly effective medicine for uterine diseases, blood purifier, colic, bilious, backbone ache, headache, dizziness, vomiting, dropsy, epilepsy and hysteria while the seeds are purgative [Shinwari et al. \(2003\)](#), [Hamayun \(2004\)](#), [Ahmad and Sher \(2004\)](#). Report indicates that *P. emodi* has the haemagglutination activity and it is a good source of lectins [Benevides et al. \(1999\)](#). Many reports also revealed that the crude extract of *P. emodi* have the antifungal and antimicrobial activity against the fungi and bacteria and useful in evaluating the toxicity of the extract [Khan et al. \(2005\)](#). The insecticidal activity of the crude extract of *P. emodi* was found interested in the discovery of botanical insecticides as alternatives to the synthetic ones, which possess well-known adverse effects on agro ecological systems [Pavela \(2004\)](#). Scientifically it has various other physiological activities including prevention of epileptic attacks, cholera and whooping cough [Watt \(1982\)](#).

Due to the multipurpose uses of *P. emodi*, the species is being used and continuous harvesting by the inhabitants of Garhwal Himalayan region since past. However, the species could not gain the significant place in the large scale. Therefore, documentation of traditional knowledge and population density is required to assess the current status. The findings of the study may be requisite in the promotion of traditional healthcare system and formation of conservation strategies of the targeted species in its natural habitats.

2. MATERIAL AND METHODS

2.1. STUDY AREA

The study was carried out in randomly selected villages in Garhwal region of Uttarakhand, India i.e., Triyuginarayan, Pothivasa, Randhar Bangar, Gwaldam and Shyalmi (Table 1 Figure 1). The detailed location lies between 30°01'35"N to 31°08'58"N latitude and 78°06'09.2"E to 79°31'04"E longitude along an altitudinal gradient of 1800 to 2800 m asl. The NASA Shuttle Radar Topographic Mission (SRTM) Digital Elevation Model (DEM) data, which has a spatial resolution of 90 m and is available on the CGIAR-CSI website (2018), was used to display elevation information in the study area map.

Table 1 Details of the study sites and density recorded for *Paeonia emodi* in different locations

S/N	Study site	Forest type	Dominant/associate plant species	Latitude	Longitude	Altitude (m asl)	Density (Individual/m ²)
1	Triyuginarayan	Shady moist forest	<i>Oak species</i> , <i>Aesculus indica</i> , <i>Litsia elongata</i> , <i>Geranium wallichiana</i> , <i>Lingularia amplexicaulis</i> , <i>Rosa sericea</i> , <i>Berberis asiatica</i> , <i>Prinsepia utilis</i> , <i>Sarcococa saligna</i>	30°26'45 "N	78°54'79 "E	2250	3.80
2	Pothivasa	Shady moist forest	<i>Oak species</i> , <i>Berberis asiatica</i> , <i>Litsia elongata</i> , <i>Paris pollyphylla</i> , <i>Potentilla fulgance</i> , <i>Rosa macrophylla</i> , <i>Prinsepia utilis</i>	30°30'0" N	79°09'50 "E	220 0	2.46
3	Randhar	Shady moist forest	<i>Oak species</i> , <i>Rhododendron arboreum</i> , <i>Sarcoca spp</i> , <i>Buxus wallichiana</i> , <i>Aesculus indica</i> , <i>Paris pollyphylla</i> , <i>Daphniphyllum himalayense</i> , <i>Prinsepia utilis</i>	30°27'52 "N	78°53'28 "E	205 0	2.06
4	Gwaldam	Shady moist forest	<i>Oak species</i> , <i>Juglans regia</i> , <i>Betula nepalensis</i> , <i>Myrica esculanta</i> , <i>Sarcococa saligna</i> , <i>Aesculus indica</i> , <i>Paris pollyphylla</i>	30°01'35 "N	79°31'04 "E	182 7	1.89

4	Shyalmi	Shady moist forest	<i>Litsia elongata</i> , <i>Juglans regia</i> , <i>Betula nepalensis</i> , <i>Myrica esculanta</i> , <i>Aesculus indica</i> , <i>Paris pollyphylla</i> , <i>Sarcococa saligna</i>	30°30'24 "N	79°10'44 "E	226 0	2.72
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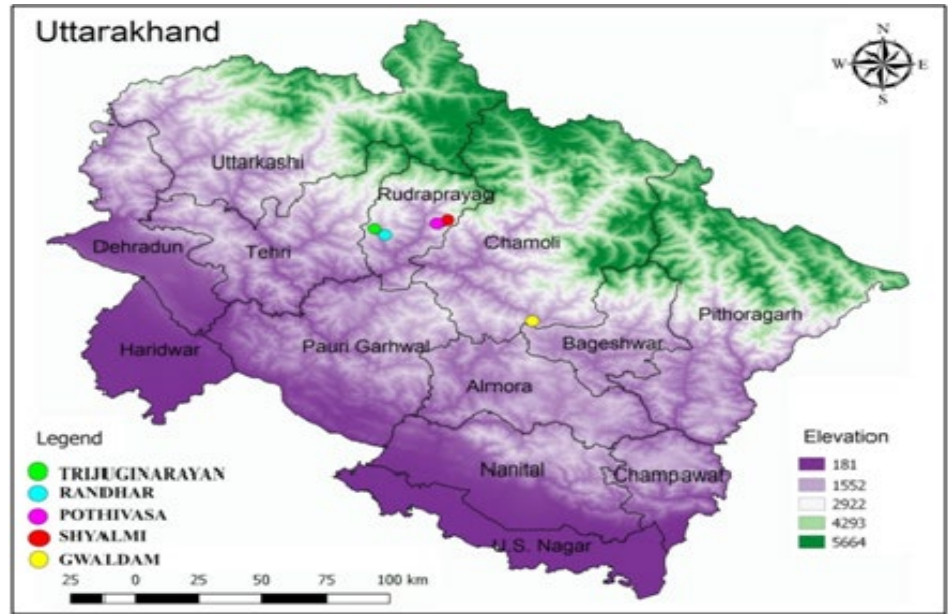


Figure 1 Different locations of study sites in Uttarakhand (Source: CGIAR-CSI (2018))

2.2. DATA COLLECTION

Extensive field surveys were conducted from May 2018 to August 2019 and the study populations were selected after exploring each site with the concern of local representatives. For the present task, months of July and September (Rainy season) were selected for collection of data on vegetation assessment so as to ensure maximum coverage of population.

Village meetings and general interaction done with the prior consent of villagers, about 40% of the inhabitants were interviewed regarding their dependence on forest resources particularly for the collection of medicinal plants and wild edibles. The informants/participants were of different age groups viz., younger to older. Semi-structured questionnaire was developed in English and Hindi. Information such as local name of the plant, part use, diseases for which plant or plant part is used, traditional consumption methods and recipes of preparation were documented based on interview. For verification of information, group discussions were held with local inhabitants and herbal practitioners (Vaidhyas or Dai) of the villages following the previous studies (Phondani et al., 2010) Dhyani et al. (2011), Negi et al. (2018). Quadrant method Misra (1968) was used to study the plant density. For sampling, 1×1 m quadrates were randomly laid down.

2.3. SPECIES IDENTIFICATION

Specimen was identified with the help of regional floras [Naithani \(1984\)](#), [Gaur \(1999\)](#). Local names of the plant were recorded with the help of local inhabitants and old aged traditional healers (Vaidhyas). However, the final taxonomic authentication was established after consulting with the help of plant taxonomist. A voucher specimen of *P. emodi* was preserved by following the standard herbarium methods [Jain and Rao \(1977\)](#) and submitted in the herbaria of Botanical Survey of India, Dehradun, Uttarakhand (BSI/NRC-Tech/Herb/Ident. /2017-18/plant accession no.118052).

3. RESULT AND DISCUSSION

According to local inhabitants of the higher Himalayan region in Uttarakhand, the soup and cooked vegetables from immature twigs of *P. emodi* are very useful for diabetic patient and also in improvement of body resistance. Therefore, they collect the species for the said purpose during February and March. Traditionally, the leaf and stem in juvenile phase are used as a wild edible (fresh vegetable) by local inhabitants while fleshy roots are used for treatment of uterine diseases and as blood purifier. Due to its medicinal properties and demands, local peoples are also preparing bio-prospecting products such as pickle and dry chunks to enhance their economic status in few regions of the study area. Similar findings were observed by [Joshi et al. \(2018\)](#) from the Garhwal Himalaya.



Figure 2 Mature plants of *Paeonia emodi* (A-B) and collected immature twigs by villagers for consumption (C).

During the present study it was found that the plant is still collected by local peoples from the wild in unscientific manner (immature twigs before seed shedding) to fulfill demands for manufacturing the local products such as pickle, dry chunks and juice which is rapidly pushing the plants in high degree of risk in its habitats ([Figure 2](#)). Our findings were agreed with [Joshi et al. \(2018\)](#) with respect to bioprospecting of *P. emodi* for livelihood enhancement in Western Himalayan region.

A reconnaissance done by the research team working on its conservation in Uttarakhand, particularly in Garhwal Himalayas, reveals that, only few pockets or individuals of *P. emodi* are higher dense in Triyuginarayan, Shyalmi areas (3.80 and 2.72 individual/m² respectively) while remaining are lower dense under diverse climatic conditions ([Table 1](#)). In fact, the remaining intact patches are also decreasing rapidly due to invasion by several biotic and abiotic factors such as soil properties, forest fire, trampling by animal and human interferences. Similar kind of study by [Prakash et al. \(2020\)](#) revealed that Low population density of *P. emodi* along with increasing elevation is due to the unfavorable climatic conditions and

lack of association with tree species like Oak, Pine and Rhododendron. Using available information based on present field survey, it is assumed that the causes of its degradation are largely overexploitation of immature twigs before flower formation and seed shedding, low regeneration in the natural habitats, lack of awareness about the propagation methods, clearing of forests for developmental activities, i.e., constructions of roads and canals in many natural habitats.

4. CONCLUSIONS

To conserve *P. emodi* for future prosperity, government needs to take immediate and concrete initiatives or imposed the ban on illegal collection or removal of the species from its natural populations and emphasize the promotion of conservation. Keeping in view of the importance and conservation value of *P. emodi*, some important conservation measures need to be applied, i.e., notify the natural populations for the protection of its habitats, detailed study on phenology with understanding of whole life cycle, sustainable collection of plants for commercial use, development of efficient propagation methods for developing large scale planting materials, establishment of nurseries in nearby areas for easy availability of plants to local peoples, rehabilitation of species before taking any developmental activities, creation of awareness among the local peoples about loss through over exploitation and promotion of cultivation in farmers' fields. Since policy-makers and scientist cannot conserve the species without wider support from the local communities and government agencies particularly forest department, a multi-faceted effort is required to conserve the species in the long run.

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6. CONFLICTS OF INTEREST

The authors declare they have no conflicts of interests.

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