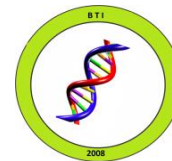




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Short Communication

PHYSIOCHEMICAL CHARACTERISTICS OF SOIL IN NANDA DEVI BIOSPHERE RESERVE (*VALERIANA JATAMANSI* JONES) IN DIFFERENT FOREST

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ABSTRACT: Nanda Devi Biosphere Reserve is one of the conservation sites in India. The physico-chemical properties of soil collected from these sites (Rhododendron forest, mixed forest and mixed temperate deciduous forest) were analyzed for organic carbon and holding capacity. The results showed that the higher percent of moisture and organic carbon (OC) percentage was in Joshimath (mixed forest) and highest population of *V. jatamansi* was also found in Joshimath. Better soil moisture and maximum soil (OC) must have supported greater population of the *V. jatamansi* plants. At Chamoli site, where both soil moisture and soil OC were low, the population of plants was also lowest across the three sites.

Keywords: Endangered, Deciduous, Organic Carbon, Soil, Physico-chemical

Introduction

India is one of the 12-mega diversity centres in the world. It has two out of the 18 biodiversities “hot spots” in the Himalaya region,

The Eastern Himalaya and the Western Ghats (Mayers, 2000). The country with 2% of the total geographical area of the world supports about 7% of the world’s biological resources. About 48,000

species of plants (about 11% world's flora) are estimated to be found in the country, among them 15,000 species are Angiosperms (flowering plants), about 65 Gymnosperms and 1020 species are Pteridophytes (Savant *et al.*, 2000). About 35% of flowering plants are endemic to the country (Ved, P. 1999; Kumar *et al.*, 2013). India is a natural home of medicinal and aromatic plants that are being used in curing many diseases since long time. It has a great wealth of medicinal plants and traditional medicinal knowledge. The Indian Himalayan region (IHR) alone supports about 18,440 species of plants, of which about 45% possess medicinal properties. Out of the total species of vascular plants, 1748 species are medicinal (Samant *et al.*, 1998). Plants from the IHR are being used for curing many diseases since centuries. India is known for its rich source and knowledge of indigenous system of medicine, namely Ayurveda, Siddha, Unani, Homeopathy, Yoga & Naturopathy that are still being used for health care; thus the Himalayan region serves as a major habitat of medicinal and aromatic plants and many compounds of plant origin have resulted in the formulation of modern medicines. (Samant *et al.*, 1995).

Uttarakhand, a hill state of IHR, is also a storehouse of medicinal and aromatic plant species including herbs. It has been declared an

'herbal state'. Among the different families of important medicinal plants found in Uttarakhand, the family *Valerianaceae* has been considered as important as about two-third of the total number are of medicinal and other ethno-botanical significance. It comprises 13 genera and 4000 species, widely distributed in cool and temperate regions of the world. *Valerianaceae* contain various species that come under 'endangered' category. In India, the family (*Valerianaceae*) has 16 species and 6 species occur in Uttarakhand.

There are numbers of medicinal herbs found in IHR region, which have highly medicinal values. Among the genus *Valeriana*, *jatamansi* is one species, which comes under the 'endangered category' (Samant *et al.*, 1999). *V. jatamansi* has been used for its bitter and aromatic qualities in most part of the world. The root of *V. jatamansi* is boiled with liquor ice, raisins, and aniseed, and for those who are troubled with cough, it helps to open the passages. The roots possess antispasmodic and depressant action on central nervous system and used as a stimulant and carminative. The oil derived from rhizome is used as a tonic and stimulant in pharmaceutical preparation and in perfumery. Moreover, the root is used in preparation of tincture; extracts, infusion, medicinal tea and extraction of volatile oil, as well as the solvent extracted absolute were used for flavoring of tobacco and beer.

Valepotriates are important phytoconstituent of *V. jatamansi* plant. Freeze dried preparation of valepotriates are manufactured. Varelepotriates are non-glycosidiciridods and are known possess tranquilizing activity in animals (Houghton, 1996; Kumar *et al.*, 2013).

According to CAMP report 1998 *Valeriana, jatamansi* comes under critically endangered species. For its conservation tissue culture is the best technique. Before using tissue culture for the conservation, there is a need of actual status of plant in the field and the climatic conditions is required for its cultivation. The main objective of this study was to investigate the status of *V. jatamansi* and climatic condition, soil analysis of the site under study.

Materials and Methods

Study area:

The study was carried out in June 2012 in Nanda Devi Biosphere Reserve (NDBR) which is located in the district of Chamoli, Pithoragarh and Bhagshwer in the state Uttarakhand. It is situated between 30°05'-31°02' N Latitude, 79°12'-80°19' E Longitude.

In order to understand the status of population of *V. jatamansi* plants in the NDBR and adjoining areas three localities within and outside the Nanda Devi Biosphere Reserve (NDBR) viz., Joshimath, Chamoli and Gopeshwar in Uttarakhand (**Figure 1**)

representing buffer and transition zones were studied.

In *V. jatamansi*, germination takes place in the month of June. 15 quadrates (1x1 m size) were randomly laid out across the three localities and plants of *V. jatamansi* were counted. Soil (at 10 cm depth) was recovered from three quadrates randomly from all the three sites. Thus, a total of 3 soil samples were collected. Soil was kept in airtight polythene bags and brought to the GBPIHED laboratory for analysis of soil moisture and soil organic carbon.



Figure: 1 Map of study site Gopeshwar, Chamoli and Joshimath (Red balloon) made in Google earth.

Soil moisture Assay/measurement

In vitro soil organic carbon is a broad measure of soil fertility and shows degradation when the soil OC value is very low. Soil (OC) is also directly related with soil nitrogen. Soil moisture was measured in laboratory. (Schmugge *et al.*, 1980).

Two gm of soil from each sample was weighed and then the soil was put in oven for drying at 110 °C for 24h. After 24h, soil samples were weighed and present moisture contain was calculated using following formula.

$$\text{Percent Moisture Content, Dry Basis} = \frac{W_t - W_s}{W_s} \times 100$$

Where: W_t = weight of soil and water

W_s = Dry soil weight (weight of soil solids)

Soil OC assay

Soil organic carbon was measured following wet digestion method (Walkley, 1947). 5g of 2 mm soil was grinded in mortar and pestle. 0.50 g of 0.5 mm (35 mesh) soil was taken into 125 ml Erlenmeyer flask (triplicate). Two blank flasks were taken to standardize FeSO_4 solution. 10 ml of dichromate solution was taken in flasks and 20 ml of concentrated H_2SO_4 was added rapidly and kept for 30 minutes. After 30 minutes, 30 ml of distilled water and 3-4 drops of O-phenanthroline were added. From burette, ferrous sulphate solution was rapidly added. Initially the color was dark brown which quickly changes from greenish blue to reddish brown. There after reading was noted.

$$\text{OC in soil (\%)} = \frac{M \times V_1 - V_2}{\text{weight of soil sample (g)}}$$

M = Molarity of FeSO_4 solution.

V_1 = Volume of FeSO_4 required for the blank (ml).

V_2 = Volume of FeSO_4 required for the sample (ml).

Results:

Soil moisture varied from 25.0 – 46.0% across the three study sites (Table 1). Similarly, soil organic carbon also varied across the study sites. Maximum value of soil OC was recorded at Joshimath and minimum at Chamoli.

Table 1: Soil physico-chemical parameters of the three study sites (habitats of *V. jatamansi*).

Soil physico-chemical parameters	Chamoli	Joshimath	Gopeshwar
Moisture (%)	28.0±0.01	46.0±0.01	25.0±0.19
Organic carbon (%)	1.01 ± 0.01	1.41± 0.01	1.37 ± 0.02

Population of *V. jatamansi* was recorded lowest at Chamoli (2.2 plants / sq. meter) and highest at Joshimath (2.6 plants / sq. meter) (Table 2, Figure 2). On average across the three sites the population was 2.4 plants / sq. meter.

Table 2: Population status of *V. jatamansi* across three locations in the study area

S. No. Quadrate / Site	Forest type in the surrounding area	Altitude (m. asl.)	No. of plants/Quadrate
Q1 Chamoli	Rhododendron forest	1600	1
Q2 Chamoli	Rhododendron forest	1600	2
Q3 Chamoli	Rhododendron forest	1620	4
Q4 Chamoli	Rhododendron forest	1630	1
Q5 Chamoli	Grassland forest	1650	3
Mean			2.2
Q6 Joshimath	Grassland forest	1650	4
Q7 Joshimath	Rhododendron forest	1660	2
Q8 Joshimath	Rhododendron forest	1500	3
Q9 Joshimath	Rhododendron forest	1530	2
Q10 Joshimath	Mixed forest	1540	2
Mean			2.6
Q11 Gopeshwer	Mixed temperate deciduous forest	1750	5
Q12 Gopeshwer	Mixed temperate deciduous forest	1800	2
Q13 Gopeshwer	Mixed temperate deciduous forest	1800	1
Q14 Gopeshwer	Mixed temperate deciduous forest	1800	1
Q15 Gopeshwer	Mixed temperate deciduous forest	1820	3
Mean			2.4
MEAN across 3 sites			2.4

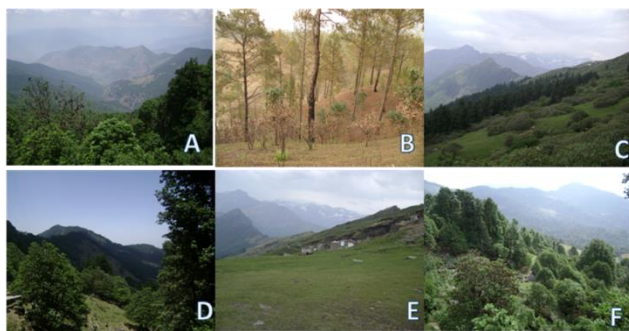


Figure 2: Forest vegetation of the study area.
A- Mixed temperate coniferous forest, B- Pine forest, C- Dwarf *Rhododendron* scrub, D- Alpine birch/ fir forest, E-Grass land, F- Mixed temperate deciduous forest.

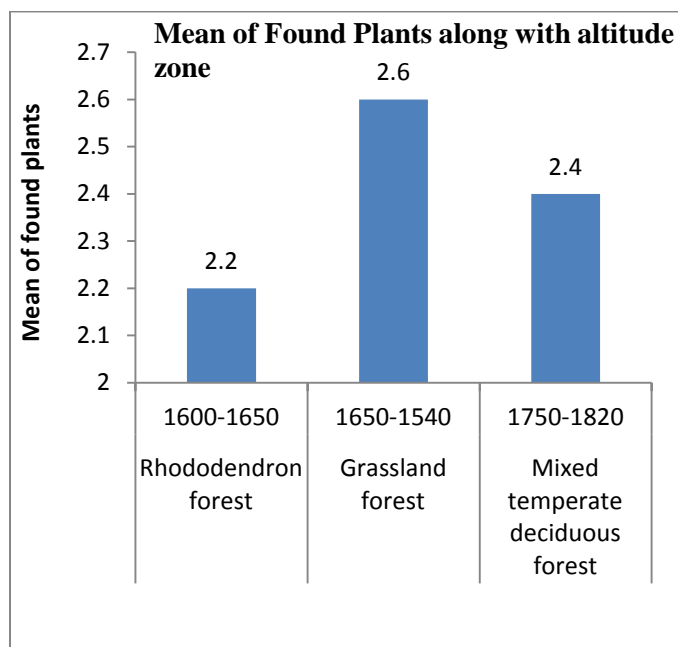


Figure 3: Graphical representation of *V. jatamansi* plants with forest type and along with altitude zone.

Discussion:

In order to understand the status of population of *V. jatamansi* plants in the study region and adjoining areas three localities within and outside the NDBR (viz., Joshimath, Chamoli and Gopeshwar in Uttarakhand) representing buffer and transition zones were studied in June 2012.

Soil moisture varied from 25.0 – 46.0% across the three study sites. Similarly, soil organic carbon also varied across the study sites. Maximum value of soil OC was recorded at Joshimath and minimum at Chamoli. Presumably better soil moisture and maximum soil OC must have supported greater population of the *V. jatamansi* plants. At Chamoli site, where both soil moisture and soil OC were low, the population of plants was also lowest across the three sites. Values of organic C reported here are comparable to that reported for the Oak and Pine forests of western Himalaya. In Oak forest Bhandari *et al.*, 2000 has reported 2.1 – 2.5% OC; and in Oak mixed forest OC values (1.33 – 1.8%; Kumar *et al.*, 2006). Similarly, in Pine forests lower values of OC (1.77%) and in Pine mixed forests still lower OC values (0.62 – 0.75%) have been reported.

There are some other factors like that sun light and radiation which directly effects on growth of plant. Rich frequency of sunlight was

found in grasslands but in mixed temperate deciduous forest and Rhododendron forest, the frequency was found to be less due to height of other plants present within the studied location. *Valerianaceae* contain various species that come under endangered category. For the conservation of endangered species tissue culture is an important technique, after concerning the data tissue plant would be use for tissue culture.

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