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Dwindling status of *Trillium govanianum* Wall. ex D. Don - A case study from Kullu district of Himachal Pradesh, India

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Trillium govanianum Wall. ex D. Don, a lesser known medicinal plant in trade during past decades has gained popularity in commercial utilization these days. This species is locally known as Nagchhatri and distributed between 2,500 to 4,000 m across the Himalayan region. Roots of this taxon are used to cure dysentery. In 2011, due to unscrupulous extraction of this species from wild in Kullu district of Himachal Pradesh, its population has decreased to a great extent. Such practices have left the species in dwindling condition. Therefore, the present study has been carried out to assess the quantum extraction and income generation from this species. The surveys were conducted in 16 representative villages of Upper Beas, Parbati, Banjar and Lag valleys and Mohal Khad Watershed of Kullu district in Himachal Pradesh. Maximum extraction (that is, 607 kg) was done in Upper Beas Valley (UBV) and inhabitants earned Rs. 5.46 crores, whereas minimum extraction was done from Mohal Khad Watershed (that is, 89.5 kg/day) and inhabitants earned Rs. 80.55 lakh during three months. Unsustainable commercial harvesting with other biotic pressures synergistically posed a severe threat to its existence in natural habitats. Therefore, for the conservation and management of species, population assessment using quadrat method, development of conventional and *in vitro* propagation protocols for mass multiplication, promotion in *ex-situ* and *in-situ* environment, and awareness among the inhabitants are suggested.

Key words: Biodiversity, Himalayan region, conservation, native, threatened.

INTRODUCTION

Plants have been used since antiquity to heal ailments and improve wellbeing. As a result of growing interest in medicinal plants, new income generating opportunities are opening up for rural inhabitants. Himalayan medicinal plants appear to have been traded for millennia (Ved et al., 1998).

The trade in medicinal plants for herbal remedies is large and probably increasing. Inequitable extraction of wild herbs in the Indian Himalayan Region (IHR) is on the

peak. Of the estimated 30,000 known medicinal plants of the world, about 8,000 are found in India (Kumar and Katakam, 2002). While this increased over the years, their availability in the wild has declined (Dhar et al., 2000).

In recent years, the demand for medicinal plants has increased substantially both at local and global markets. The instant growing demand of plant based drugs is creating high pressure on the wild populations. It is estimated that approximately 90% medicinal plants in commercial use are collected from the wild habitats, of which 70% collection involves destructive harvesting (Ved et al., 1998; Samant et al., 2008). The trade of plants is now no longer limited to traditional healers but

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Figure 1. (A) Plant of *Trillium govonianum*; (B) population; (C) collection of *Trillium govonianum* and (D) post harvest processing.

has come into the entrepreneurial zone. Of the 1,748 species of medicinal plants recorded from the IHR (Samant et al., 1998), about 120 medicinal plants have been grouped under different categories of International Union for Conservation of Nature (Samant et al., 1998; Ved et al., 2003, 2005) and 17 species have been listed in the Red Data Book of Indian Plants (Nayar and Sastry, 1987, 1988, 1990). There has been an increase in medicinal plants trade at local, regional and international levels, as urbanization has caused the subsistence consumer to be distanced from harvesting areas (Maeshall, 1998).

If these activities continue and necessary steps are not taken to check its conservation, then around 4,000 to 10,000 medicinal plants can become endangered at the global level (Edwards, 2004). With the increasing population, demand for economically important species has increased greatly. This has led to the over exploitation and habitat degradation of the biodiversity elements (Rana and Samant, 2009). Incessant exploitation of several medicinal plants from the wild has resulted in their population decline over the years (Samant et al., 1998).

Amongst the threatened medicinal plants, *Trillidium govonianum* (Wall. ex D. Don) Kunth is a native species of the Himalayan region (Samant et al., 1998; Anonymous, 1883, 1970) and distributed in the Himalaya, Bhutan, Nepal and China between the elevation range of 2,500 to 4,000 m. It belongs to Trillidiaceae family (Aswal and Mehrotra, 1994; Chauhan, 1999) and locally known as Nagchhatri in Kullu area of Himachal Pradesh. It can be identified by its three leaves in one whorl at the summit of the stem and a solitary, purple flower in the centre. Leaves are broadly ovate, acute and conspicuously stalked (Figure 1A-B). Flowers are brown purple with narrow petals. Roots contain trillarin, which on hydrolysis yield 2.5% diosgenin (a corticosteroid hormone) (Chauhan, 1999). Over exploitation from the natural habitats, to meet the demand of pharmaceutical industry, has caused its population depletion to a great extent (Figure 1C to D).

Kullu district is one of the twelve districts of Himachal Pradesh in India, and is known for natural, unique and economically important biodiversity. It is situated between 31° 58' 00"N latitudes and 77° 06' 04"E longitudes and covers 5,503 km² geographical area. Altitude ranges from

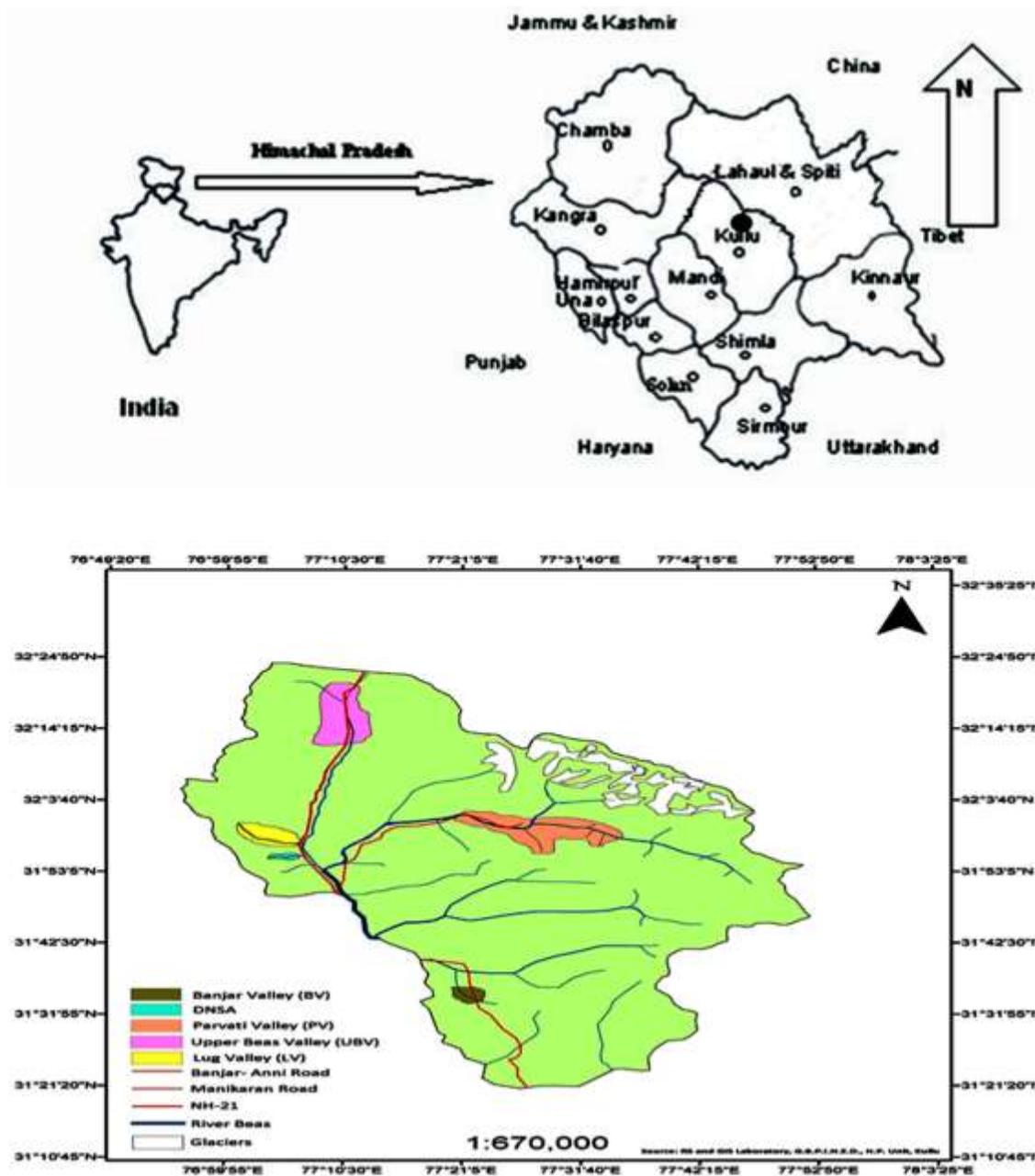


Figure 2. Study area.

900 to 6000 m above mean sea level. The district stretches from Rampur in the South to the Rohtang Pass in the North and is bounded on the North and East by Lahaul-Spiti, South-East by Kinnaur, South by Shimla, South-West and West by Mandi and North-West by Kangra districts of the State (Figure 2). It represents the biodiversity of Great Himalayan National Park and Kais, Kanawar, Khokhan, Manali, Sainj and Tirthan Wildlife Sanctuaries. The district has rich medicinal plants diversity and about 500 species of medicinal plants have been estimated by Samant et al. (2007a). Medicinal

plants have played an imperative role in the treatment of various diseases by providing raw material to the local herbal healers. The native people of this district have been using these resources for treating various ailments in their daily life since time immemorial. With increasing demand and renewed global interest in traditional ethnopharmacy, coupled with the increasing preference for natural substances in the healthcare system, the natural stock of medicinal plants of Himachal Pradesh is under tremendous pressure (Samant et al., 1998). The review of literature indicates that *T. govianum* Wall. ex

D. Don is widely distributed in the IHR between 2,500 to 4,000 m but in 2011, the population in the wild habitats of the species had gone down to a great extent due to the large scale exploitation. This left the species in dwindling status. Keeping in view the current status of the species, 16 representative villages from Upper Beas, Parbati, Banjar and Lag Valleys and Mohal Khad Watershed were selected to assess the quantum extraction and income generation from the species. The inhabitants from Kothi, Ruar, Palchan, Chhayal and Kulang villages in Upper Beas Valley; Tosh, Tulga and Grahan villages in Parbati Valley; Ghyagi, Shojha and Jibhi villages in Banjar Valley; Tiun and Khadincha villages in Lag Valley; Lot, Dabri and Tehrenseri villages in Mohal Khad Watershed (Table 1) collected *Trillium* roots from the forests. The main areas of collection in Upper Beas valley were, Hamta, Rani nalla, Jamu Dhug, Dundhi, Fakru, Bakru Thatch, Kothi Jot Kelgu butru, Deusu and Seri nalla; in Parbati Valley; Thunja, Kheer Ganga, Pandu Pul, Malana, etc.; in Banjar Valley; Lamba lambhri, Sakiran, Hirb, Seolsar, Chhera, Rajjandi, Raghupur Jot, etc.; in Lag Valley; Sruni, Bhabsi, Sori and Machak Jot; and in Mohal Khad Watershed; Munjhak, Nanga Dhardha, Hathipur, Tarapur Garh, Bhubu Jot, etc. These sites comprising of temperate and sub-alpine forests, are mainly dominated by broadleaved and coniferous species, and alpine meadows which are dominated by alpine scrubs and herbaceous species in Upper Beas, Parbati, Banjar and Lag Valleys. The dominant trees and shrubs found during the surveys were *Quercus semecarpifolia*, *Picea smithiana*, *Abies pindrow*, *Betula utilis*, *Rhododendron campanulatum*, *R. anthopogon*, *Juniperus indica*, *Rosa macrophylla*, *R. sericea* and *Salix lindleyana*.

MATERIALS AND METHODS

Surveys were conducted between June to August, 2011 in 16 representative villages. Adults from each family were interviewed with the help of semi-structured questionnaires. The questions were mainly focused on distribution of the species, part(s) used, quantum extraction, number of persons involved in collection and availability of the species in the area. For each village, geo-coordinates and altitude were recorded by using Geographical Positioning System (GPS). Population of the villages are based on the information provided by the Panchayat Pradhans. The information was analyzed for average collection per person per day, total collection and total income generated (Table 1).

RESULTS AND DISCUSSION

The study revealed that extraction of *Trillium* roots was done for about three months that is, June to August. Valley and watershed wise name of the villages, latitudes and longitudes, altitude, total population, persons involved in total collection and total income generation are presented in Table 1. Amongst the villages of Upper Beas Valley, Kothi, Ruar and Kulang, respectively collected the maximum quantity; in Banjar Valley, Ghyagi

village; in Lag Valley, Tiun village; in Parbati Valley, Kalga village, and in Mohal Khad watershed, Dabri village collected the maximum quantity. Valley wise, maximum extraction that is, 607 kg was done in Upper Beas Valley (UBV) and earned Rs. 5.46 crores, and minimum extraction from Mohal Khad Watershed that is, 89.5 kg and earned Rs. 80.55 lakhs (Table 1). The responses of the persons involved in extraction revealed that approximately 450 plants of *T. govaniatum* were uprooted to produce one kilogram dry weight of the roots. The high and low quantity of collection of the species is due to the availability of species in these areas. The present study showed that total 6,36,975 plants were uprooted.

Biodiversity has always been one of the best livelihood options, as it provides various services to mankind. Amongst the various components of biodiversity, medicinal plants are very well known as livelihood option (Samant et al., 1998, 2007b). *T. govaniatum* can be the best example as this species is commercially exploited for trade and livelihood by the villagers. During the recent 2 to 3 years, increasing demand of this species has resulted in over-exploitation from the wild. Trade in the study area is largely unregulated. The region does not have any certification standards and ends up losing hefty revenue. The inhabitants are largely dependent on forest resources for their livelihood, primarily the collection and trade of medicinal plants. The inhabitants of 16 villages studied in the present study collected 127 tons dried rootstock and earned Rs.13.01 crores. For this, the villagers uprooted 6,36, 975 plants before seed setting. They found it a lucrative business because extraction of *T. govaniatum* has substantially improved their financial conditions. But, this unethical and unauthorized practice is to be prohibited strictly as this may lead to extinction of the species from the area. During the surveys, it was found that inhabitants of the area were also exploiting *Paris polyphylla* Sm. in the name of Nagchhatri. But, after the interviews and proper identification of the species, *T. govaniatum* turned out to be the actual Nagchhatri. Such practices may create problems in marketing and may also cause harmful effects to humans if consumed as medicine. The lack of technical expertise to harvest the species may lead to early extinction from natural habitats. This species propagates through roots and seeds. The seeds mature between mid September to the end of October, and the inhabitants harvest roots from June to August. The quantum extraction of roots from the study area indicates that exploitation of roots before the maturation of seeds may lead to extinction of species from the area. There is a need for the awareness among the villagers so that the roots can be collected after the maturation of seeds and their dispersal. This harvesting practice would not only ensure the availability of species for sustainability but also provide sufficient time for the maturation of roots that probably may result in high concentration of active ingredients.

Table 1. Areas surveyed under study showing geographical positions and collection trends

Area/valley	Village	Latitude/Longitude	Altitude (m)	Human Population	Persons involved in extraction	Plants uprooted (kg)	Total income (in lacs)
Upper Beas Valley (UBV)	Kothi	32°18'47"N/77°11'11"E	2477	175	65	87,750	1.95
	Ruar	32°18'47"N/77°10'57"E	2343	400	70	63,000	1.4
	Palchan	32°18'32"N/77°10'36"E	2324	100	40	30,600	0.68
	Chhayal	32°13'13"N/77°11'6"E	1935	400	50	33,750	0.75
	Kulang	32°18'09"N/77°11'02"E	2249	200	72	58,050	1.29
	Total			1275	297	273,150	6.07
Banjar Valley (BV)	Ghyagi	31°34'40"N/77°21'48"E	2035	350	45	40,500	0.90
	Shojha	31°34'05"N/77°25'15"E	2589	200	30	33,750	0.75
	Jibhi	31°35'35"N/77°20'52"E	1840	250	35	28,350	0.63
	Total			800	110	102,600	2.28
Lag-Valley (LV)	Tiun	32° 02'35"N/76°59'10"E	2549	325	46	51,750	1.15
	Kadincha	32° 02'04"N/76°59'53"E	2119	275	42	37,800	0.84
	Total			600	88	89,550	1.99
Parbati Valley (PV)	Kalga	31°59'47"N/77°27'09"E	2212	280	80	72,000	1.60
	Tulga	32°00'51"N/77°27'05"E	2371	250	60	35,100	0.78
	Grahan	31°58'17"N/77°20'49"E	2222	270	30	24,300	0.54
	Total			800	170	131,400	2.92
Mohal Khad Watershed	Lot	31°51'25"N/77°5'33"E	2034	125	25	16,875	0.37
	Dabri	31°53'01"N/77°05'41"E	1602	350	35	18,900	0.42
	Tehren Seri	31°52'51"N/77°06'07"E	1881	150	20	4,500	0.10
	Total			625	80	40,275	0.89
Grand total				4100	745	636,975	14.15

This will certainly provide high price to the villagers in the market. Therefore, harvesting of roots during mid September to October is suggested. There is a need to carryout the ecological studies to assess the current population structure

of the species in different natural landscapes for long term conservation and management plan-ing. Also, it is essential to develop conventional and *in vitro* propagation protocols for mass multiplication, promote *ex-situ* and *in-situ* conservation and

awareness among the inhabitants in the study area. Large scale cultivation of this species in its altitudinal range may help in conservation and income generation for the inhabitants (Samant et al., 2008)

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