

Ethnobotanical Importance and Utilization Patterns of Wild Plant Resources in Two Himalayan Landscapes of Uttarakhand

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ABSTRACT

Plant resources of wild plants play an important role in the sustenance and culture of the people living in the Himalayas. In this study we are presenting ethnobotanical survey data along with the calculation of TIV% of the plants of the Darma-Byans Valley (Byans valley: 52 species, 30 families, 48 genera; Darma valley: 57 species, 39 families, 53 genera) and Gangotri-Govind landscape (36 species, 29 families, 34 genera) of Uttarakhand region. The highest TIV% was found to be of *Aconitum heterophyllum* in Darma-Byans valleys (50%) and of *Paeonia emodi* in Gangotri-Govind (60%), followed by *Rhododendron arboreum* and *Urtica dioica* (50% each). Medicinal usage is the major use category in terms of number of species in both landscapes, followed by fuelwood, timber, fodder, spices/condiments and religious/sacred usage; there are also some species which have been reported to have multiple uses, like *Angelica glauca*, *Rosa sericea* and *Xanthoxylum armatum*. There are differences in the utilization of plants between the two landscapes, which is in concordance with the fact that trans-border trade in MAPs and *Cordyceps sinensis* is more prevalent in Darma-Byans valley than in the protected landscape of Gangotri-Govind.

Keywords: Ethnobotany; Himalayan plants; medicinal plants; Total Importance Value; Darma-Byans Valley; Gangotri-Govind; Uttarakhand; wild plant resources; TIV%.

1. Introduction

Traditional ecological knowledge about plants in the high Himalayas, used in medicine, food, feed, fuel wood, construction timber and religion is a major element of subsistence activities in the area. The identification of species of the highest importance in terms of resource uses, as well as the comparison of the patterns of importance in these species among different communities, is helpful not only in studying their local ways of living but also in predicting future pressures on these species.

Ethnobotanical surveys were conducted using a standardized questionnaire format in the Darma-Byans Valley and Gangotri-Govind landscapes of Uttarakhand, and Total Importance Values (TIV%) were assigned to each plant species in accordance with its uses described in the survey. The aim of this paper is to rearrange previously collected information in relation to one research problem concerning ethnobotany of the two areas.

1.1 Objectives

- To assess the diversity of wild plant resource use by the local communities.

- To find out differences in major plant uses between the two landscapes.
- To find out plant species with high Total Importance Value (TIV%).
- To find out multi-purpose plants based on use information collected.

2. Study Area and Data Source

For the collection of ethnobotanical information, the Darma-Byans Valley landscape (consisting of Pithoragarh district of Kumaun Himalaya) and villages of Gangotri-Govind landscape (Uttarkashi district of Garhwal Himalaya) have been covered. The data collected are mainly through a standardized questionnaire format among local communities, except for Darma-Byans Valley where secondary information from published literature (Farooquee and Rawat, 2001; Farooquee et al., 2004; Negi et al., 2017) has also been used in tables. A total of 91 plant species have been recorded as being used in Darma-Byans Valley landscape and 36 species in Gangotri-Govind.

3. Materials and Methods

Economic values for each usage of a species as livestock forage, medicine, human food, fuel, wood, charcoal, among others and including secondary usages like oil/ fibre extraction and soil stabilization were assigned on a linear scale from 0 to 10 based on the literature and knowledge from the local area following the example of Belal and Springuel (1996). The calculation of Total Importance Value was made according to the formula below.

$$\text{TIV\%} = [(U_1 + U_2 + U_3 + \dots + U_n) / (\text{Number of uses} \times \text{Maximum value})] \times 100$$

where U_i represents the importance value of a specific usage. The values TIV% and usage categories are copied precisely as recorded in the original tables, from which landscape-based comparison of the number of species documented and the top TIV% species per landscape can be obtained.

4. Results

4.1 Diversity of plants that were recorded to be in use

There were 91 plant species identified to have been in use in the Darma-Byans Valley area, out of which 52 plant species (30 families, 48 genera) in Byans Valley with Polygonaceae being the predominant family (4 genera, 6 species) and Asteraceae (4 genera, 5 species) and 57 plant species (39 families, 53 genera) in Darma Valley with Rosaceae being the predominant family (4 genera, 5 species). In the case of Gangotri-Govind landscape, there were 36 plants recorded (29 families, 34 genera, comprising 1 fungus, 3 gymnosperms and 32 angiosperms), with Ericaceae, Pinaceae and Polygonaceae having 2 genera and 2 species (Fig. 1).

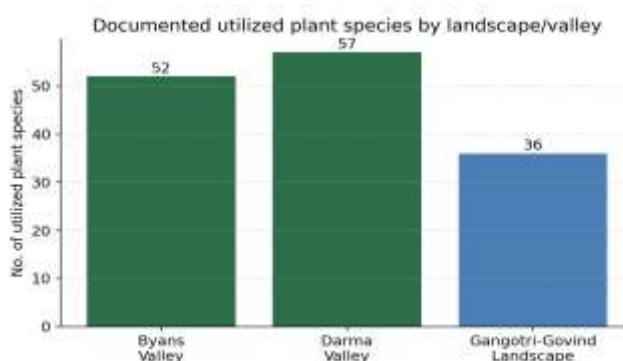


Fig. 1 - Number of documented utilized plant species by landscape/valley.

Table 1 - Number of documented utilized plant species by landscape.

Area	Families	Genera	Species
Byans Valley	30	48	52
Darma Valley	39	53	57
Darma-Byans Valley (combined)	-	-	91
Gangotri-Govind Landscape	29	34	36

4.2 Ranking of Total Importance Value (TIV%)

In the Darma-Byans Valley landscape, the highest TIV% was that of *Aconitum heterophyllum* (50%) followed by *Paris polyphylla*, *Picrorrhiza kurrooa*, *Polygonatum verticilatum* and *Swertia chirata* (each 40%), all used for medicinal purposes. In the Gangotri-Govind landscape, the highest TIV% was of *Paeonia emodi* (60%) followed by *Rhododendron arboreum* and *Urtica dioica* (each 50%) with a group of eight other species having 40%. *Pinus wallichiana* had the lowest TIV% in the Gangotri-Govind landscape (15%) (Table 2, Figs. 2a–b).

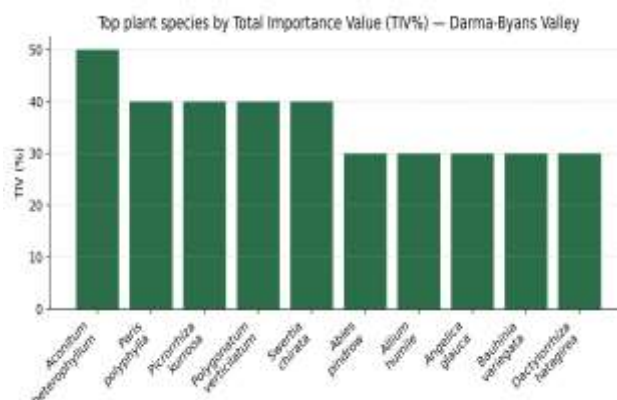


Fig. 2a - Top plant species by TIV%, Darma-Byans Valley.

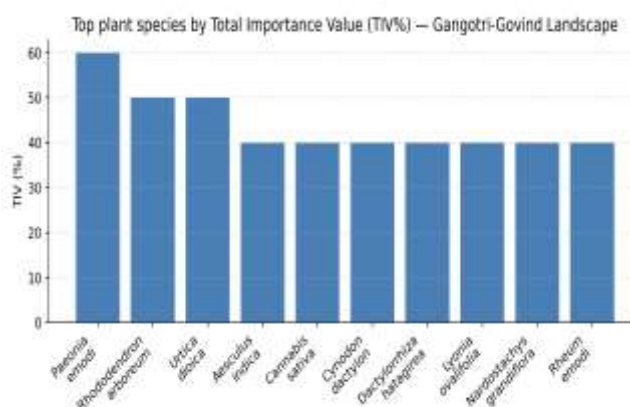


Fig. 2b - Top plant species by TIV%, Gangotri-Govind Landscape.

Table 2 - Top plant species ranked by TIV%, both landscapes.

Species	Landscape	Primary use(s)	TIV%
<i>Paeonia emodi</i>	Gangotri-Govind	Medicinal	60
<i>Aconitum heterophyllum</i>	Darma-Byans	Medicinal	50
<i>Rhododendron arboreum</i>	Gangotri-Govind	Medicinal, Religious	50
<i>Urtica dioica</i>	Gangotri-Govind	Medicinal	50
<i>Paris polyphylla</i>	Darma-Byans	Medicinal	40
<i>Picrorrhiza kurrooa</i>	Darma-Byans	Medicinal	40
<i>Polygonatum verticilatum</i>	Darma-Byans	Medicinal	40
<i>Swertia chirata</i>	Darma-Byans	Medicinal	40
<i>Dactylorrhiza hatagirea</i>	Both landscapes	Medicinal	30–40
<i>Sassurea costus</i>	Gangotri-Govind	Medicinal	40

4.3 Make use of categories and multi-purpose species

In both landscape's economic-use tables, species have been classified into repeating categories: medicinal use, spices and condiments, fuelwood, timber, sacred or religious use, fodder and in case of Darma Valley's table wild edibles. In both the landscapes, medicinal use of species takes the highest number of individual species, in accordance with the large number of diseases cured through the use of local flora followed by fuelwood/timber species and fodder species. Species repeat themselves in more than one category of use: *Angelica glauca* (medicinal and spice/condiments in both the valleys), *Rosa serocio* (medicinal and spice/condiments), *Xanthoxylum armatum* (medicinal and spice/condiments), *Betula utilis* (fuelwood, timber and religious use), *Abies pindrow* (medicinal, fuelwood and timber) and *Cedrus deodara* (medicinal, timber and fuelwood in Gangotri-Govind) (Table 3).

Table 3 - Selected multi-purpose plant species and their documented uses.

Species	Vernacular name	Documented uses	Landscape
<i>Angelica glauca</i>	Chippi/Gadrayan	Medicinal (stomach); spice/condiment	Darma-Byans
<i>Rosa serocio</i>	Shyaple	Medicinal (cuts/wounds); spice/condiment	Darma-Byans
<i>Xanthoxylum armatum</i>	Yanna/Timur	Medicinal (toothache); spice	Darma-Byans
<i>Betula utilis</i>	Bhojpatra	Medicinal; fuelwood; timber; religious use	Both
<i>Abies pindrow</i>	Wuman Shin	Medicinal (cold/cough); fuelwood; timber	Darma-Byans
<i>Cedrus deodara</i>	Devdar	Medicinal (rheumatism); timber; fuelwood	Gangotri-Govind

<i>Pinus wallichiana</i>	Chir/Galchuri	Medicinal; timber	fuelwood;	Both
<i>Nardostachys grandiflora</i>	Jatamansi	Medicinal sacred use	(jaundice);	Both

5. Discussion

Medicinal uses constitute the most common type of resource utilization, as evidenced by the high number of species reported in this category in both landscapes, as well as the fact that all highest-TIV% species in the two landscapes are medicinal – *Aconitum heterophyllum* in Darma-Byans Valley, and *Paeonia emodi* in Gangotri-Govind. This is further consistent with qualitative observations of the reliance of the local people on forests for medicinal purposes in treating various ailments ranging from digestion problems to wound healing, fever, jaundice and rheumatism. In addition to the clustering of high-TIV% species among few taxonomic groups, together with the many species that score 20% and below, it can be inferred that resource utilization importance is unevenly distributed among the flora described in the two landscapes.

The alpine meadows in Darma-Byans Valley are used intensively, with the cross-border trade of MAPs and *Cordyceps sinensis* as well as seasonal migration for grazing taking place, while the intensity of human disturbances in Gangotri-Govind is relatively less due to the protected area framework existing in the area, with MAP collection also taking place in a relatively regulated manner.

The TIV% species-level data presented in this study is not an indicator of collection intensity or trade quantity; the contrast between the two landscapes is merely a qualitative result of the survey as opposed to an independent conclusion drawn from TIV% values.

6. Conclusion

The ethnobotanical survey data presented above reveals 91 used plant species in the Darma-Byans Valley landscape and 36 used plant species in the Gangotri-Govind landscape, medicinal usage being the most predominant use category in both landscapes with highest TIV% values obtained for *Aconitum heterophyllum* and *Paeonia emodi* respectively. Several multipurpose plants such as *Betula utilis*, *Angelica glauca* and *Cedrus deodara* occur under different use categories, showing that there are certain numbers of versatile plant species with high resource-use importance among the flora recorded in this study.

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