Annals of Plant and Soil Research 26(2): 311-316 (2024)
https://doi.org/10.47815/apsr.2024.10365

Total importance value of medicinal plants in Jaunpur Range, Garhwal Himalaya, Uttarakhand

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Received, January, 2024; Revised accepted, May, 2024

ABSTRACT

The present study was intended to assess the total important value of medicinal plants in 5 villages of Jaunpur Range, Mussoorie Forest Division. Extensive field surveys were conducted at the study site throughout the different seasons of the year from November 2021- December 2022 to collect data. Data were collected using standard questionnaires. A total of 70 plant species were identified from 64 genera and 43 families. Among the 43 families, the maximum number of species were recorded in Rosaceae (8 spp.). The majority of identified species was herbs (36%), followed by trees (31%), shrubs (20%), climbers (7%), grass (4%) and ferns (2%). The ethnobotanical classification showed that most species are used for medicinal purposes (70 spp., 56%), followed by edible purposes (33 spp., 25%), uses such as fuel wood (8 spp., 7%), fodder (8 spp., 6%), timber (3 spp., 2%) and other uses (5 spp., 4%). Field observation revealed that most of the species were common (63 spp., 90%) in the study area, followed by uncommon (7 spp., 10%). In this study, the maximum number of species was found in the TIV 1-10% and the highest recorded TIV was 70%. The analysis of the total importance value (TIV) revealed that Grewia optiva, Diplazium esculentum, Berberis asiatica, Cedrus deodara, Lyonia ovalifolia Myrica esculenta, and Rhododendron arboreum were the plant species higher socioeconomic values, therefore it needs special attention and priority in conservation and management related activities.

Keywords: Medicinal, Mussoorie, TIV, Traditional, Garhwal

INTRODUCTION

India's Himalayan region, located in the state of Uttarakhand, is known for its abundance of natural resources. Forests are the main source of raw materials for plant-based medicine. Medicinal plants have been used for thousands of years as a major source of therapeutic agents. Forests are crucial for the survival and sustenance of people living in hilly regions or in proximity to them (Rawat *et al.,* 2020; Parveen *et al.,* 2018).The periodic needs for fuelwood, food, medicines, timber, and other resources, people rely on forests. According to Kala (2007), this dependence is regarded as an essential component of their economy and way of livelihood. Deforestation often occurs when natural resources are extracted from forests. This region has distinctive geographical features that make it difficult to access rural areas. As a result, the region is heavily dependent on forest resources to meet its needs. This dependence on forests may be attributed to the inaccessibility of rural areas, makes it challenging to engage in other economic activities. This reliance on forest resources has significant implications for the region's ecological balance and calls for sustainable management of the available resources. The Garhwal Himalaya is a region in India known for its rich variety of plant life, with over 300 species of medicinal plants (Gaur, 1999). People have been using the Himalayan flora for various purposes, including scientific and therapeutic uses, for thousands of years. Old Indian literature such as the Rig-veda, Atherveda and Charka Sanhita contain references to the uses of plants from this region (Sharma *et al.,* 2011). Traditional healers, who often collect plants from wild and remote areas, use many of these plant products as traditional medicine. Unlike allopathic medicine, plant-based medicine typically has no side effects (Gangwar *et al.,* 2010). In rural areas, people rely heavily on local resources for their daily needs, particularly for fuelwood and fodder. However, Protected areas are vulnerable to encroachment from tourism, business, animal grazing and plant collection (Chettri *et al.,* 2021). The Himalayan region is known for its rich forest resources. However, due to the vastness of the

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region and the presence of several under-explored biogeographical areas, To update information regarding patterns of forest resource utilization, comprehensive and intense surveys. (Samant, 1998) such surveys are necessary to understand how the forests are utilized, and how they can be sustainably managed. The utilization patterns vary depending on several factors such as elevation, vegetation, and local people (Rawat *et al.,*2018). Therefore, it is essential to gather accurate information through surveys to ensure that forest resources are utilized responsibly and sustainably.

MATERIALS AND METHODS

Study area

This study was conducted in, five villages - Kafulta, Almas, Rautu Ki Beli, Bhainswari, and Moldhar-that are part of the Jaunpur Range, Mussoorie Forest Division in Tehri, Uttarakhand. which represent temperate forests in Garhwal Himalaya. The study area is located between the latitudes 30°25.00′–30°33.00'N and longitudes 78°3.00'–078°15.00'E. characterized by high gradients, 1100 –2100 amsl altitudinal variations. A reconnaissance survey of the study area was done from December to November in the years 2021 and 2022. The meteorological data of year 2021–2022 for Jaunpur Range were taken from the accuweather (Website: www.accuweather.com and en.climate/ data/org). Monthly values of climate data were used for calculation of average annual data. The average annual rainfall of the area is 1.90 mm, of which 85% is received between July and October. Winter (November–March) rainfall is low. The mean annual maximum temperature is 35.67ºC and minimum temperature is 14.42 ºC. The mean annual moisture is 51.73%.

Demography of informants

Based on occupation, gender, and age the informants, who represented a wide range of persons, were divided into various categories. A total of 593 informants of which 362 (61%) of the informants were male, and 231 (39%) were female. In comparison to females, male participation was somewhat higher. According to this survey, 539 interviewees (91%) were farmers, while 54 (9%) were employed in government services like teachers and military. Indigenous knowledge is well-established among elder people and appears to be dwindling in the younger generation of the region. Most of the respondents were elderly persons between the ages of 40 and 60. The older generation tends to have more accurate and useful knowledge of natural resources and their diversity compared to the younger generation.

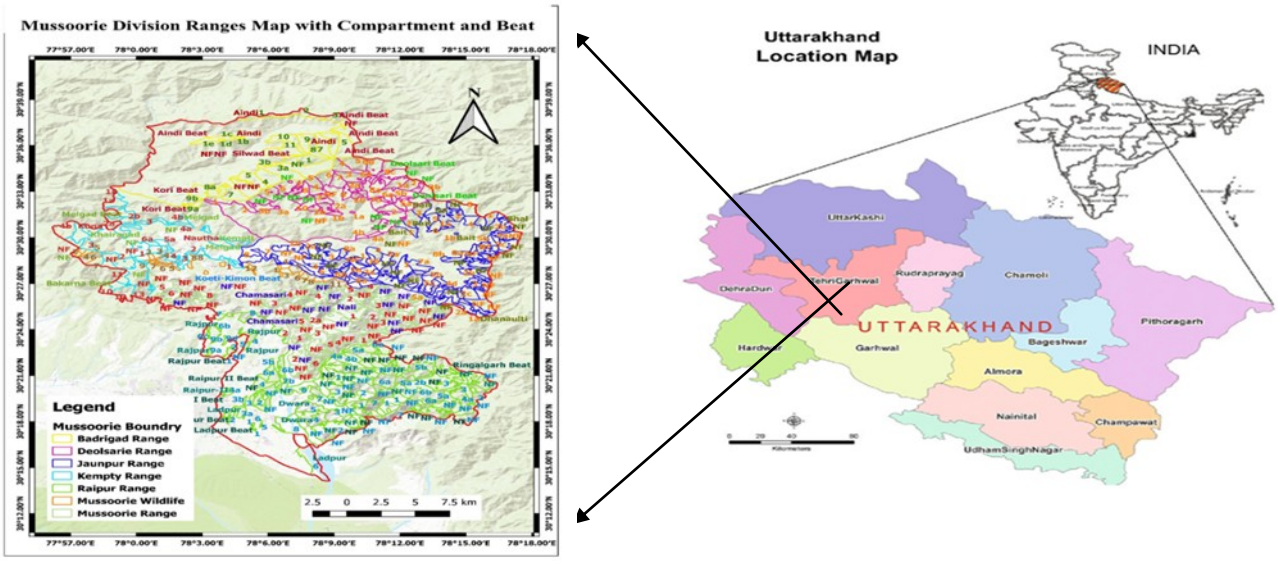

Fig 1- Showing study site details

Data collection

Extensive field surveys were conducted at the study site during the different seasons of the year November 2021- December 2022 to gather data on the socioeconomic characteristics of households and the patterns of resource usage by the villagers. The data was collected using questionnaires during interviews conducted at the informant's house in Hindi or Garhwali language. The study area had a total of 539 homes and sample houses and interview subjects were chosen at random from the total population based on their possession of traditional knowledge. During the study, various types of information were collected, including family size, occupation, income of sources, and the extraction of medicinal plants and their multipurpose value. To determine the Total Importance Value (TIV) of tree species, they were classified into main, secondary, and tertiary uses according to Belal and Springuel's method (1996). Primary uses included the value of medicine, fuel wood, fodder, timber and wild edible, while secondary applications included secondary direct benefits like tannin, fibre and oil, Tertiary uses included indirect advantages such as decorative, bee foraging, shade and nitrogen fixation. TIV was calculated by using a specific formula:

$$\text{Total Importance Value (\%)} = \frac{U1+U2+U3.....n}{Number\ of\ uses\ of\ a\ species} \times 100$$

Where,
TIV = Total Importance value, and
U = importance value for each particular use of a species.

RESULTS AND DISCUSSION

A total of 70 plant species from 64 genera and 43 families were identified. These species are used by the local population for a variety of uses. Table 1 covers the approved botanical name, Sanskrit name, local name, family name, habitat, distribution, ethnobotanical classification and total importance value % for all of these species.

Among 43 families, maximum species were recorded in Rosaceae (8 spp.) followed by Lamiaceae, Poaceae (4 spp., each), Asteraceae, Moraceae, Rutaceae (3 spp., each), Barberidaceae, Saxifragaceae, Urticaceae, Nyctaginaceae, Zingiberaceae, Ericaceae, Polygonaceae, Smilacaceae (2 spp, each), Amaranthaceae, Ranunculaceae, Asphodelaceae, Meliaceae, Caesalpinaceae, Bombacaceae, Pinaceae, Dioscoreaceae, Dryopteridaceae, Phyllanthaceae, Gentianaceae, Malvaceae, Juglandaceae, Anacardieaceae, Myricaceae, Primulaceae, Oleaceae, Oxalideaceae, Pineaceae, Linaceae, Anacardiaceae, Rubiaceae, Sapindaceae, Solanaceae, Taxaceae, Manisoermaceae, Violaceae, Lythraceae, Rhamnaceae (1 spp., each).

The analysis of life forms showed that a major proportion of species were herb (36%) followed by trees (31%), shrub (20%) climbers (7%), grass (4%) and Fern (2%). Ethnobotanical classification showed that a major proportion of species are being used for medicine Purposes (70 spp., 56%) followed by edible purposes (33 spp., 25%) uses as fuel wood (8 spp., 7%), fodder (8 spp., 6%), timber (3 spp., 2%) and other use (5 spp., 4%). Field observation revealed that most of the species were common (63spp., 90%) in occurrence the study area followed by uncommon (7 spp., 10%).

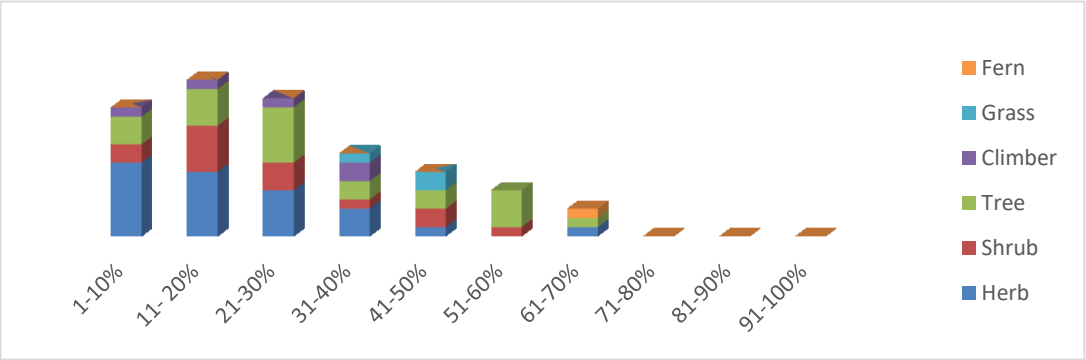

Fig 2 - Distribution of species and life forms into different TIV categories

Table 1: TIV (%) of Medicinal Plant Species in Jaunpur Range

Scientific Name	Sanskrit name	Local Name	Family	Hb	Dist.	EC	TIV%
Achyranthes aspera L.	Apamargah.	Chirchira	Amaranthaceae	H	C	Md	10%
Aconitum heterophyllum Wall. ex Royle	Aruna	Atis	Ranunculaceae	H	C	Md	10%
Ajuga integrifolia Buch.-Ham. ex D.Don	-	Neelkanthi	Lamiaceae	H	UN	Md	30%
Aloe vera (L.) Burm.f.	Ghartkumari	Aloevera	Asphodelaceae	H	C	Md, Ed	40%
Artemisia nilagirica (C.B.Clarke) Pamp.	damanaka, damana	Tilpaat	Asteraceae	S	C	Md	20%
Azadirachta indica A.Juss.	Nimba	Neem	Meliaceae	T	UN	Md	30%
Bauhinia variegata L.	Kanchanara	Guiral	Caesalpinaceae	T	C	Md , Ed, Fu	50%
Berberis asiatica Roxb. ex DC.	Daruharidra	Kingoda	Barberieaceae	S	C	Md, Ed, Fu	60%
Berberis napaulensis var. napaulensis	-	khoru	Berberidaceae	S	UN	Md, Ed	50%
Bergenia ciliata (Haw.) Sternb.	Pashanbheda	Pashanbheda	Saxifragaceae	H	UN	Md	30%
Bergenia stracheyi (Hk.f. & Th.) Engl.	Pashanbheda	Pashanbheda	Saxifragaceae	H	C	Md	40%
Bergera koenigii L.	-	Kadi patta	Rutaceae	T	C	Ed, Md	20%
Boerhavia diffusa L.	Punarnava	kummar	Nyctaginaceae	H	C	Md	10%
Bombax ceiba L.	shaalmali	Semal	Bombacaceae	T	UN	Ed, Ti, Md	30%
Cedrus deodara (Roxb. ex D.Don) G.Don	Devadaru	Devodar	Pinaceae	T	UN	Md, Fu,Ti	60%
Cynodon dactylon (L.) Pers.	Durva	Doob	Poaceae	H	C	Md , Ot	50%
Dioscorea bulbifera L.	Varahi-kand	Genthi	Dioscoreaceae	Cl	C	Md, Ed	40%
Diplazium esculentum (Retz.) Sw.	-	Lingura	Dryopteridaceae	Fn	UN	Md, Ed	70%
Duhaldea cappa (Buch.-Ham. ex D.Don) Pruski & Anderb.	Pushkaramula	-	Asteraceae	H	C	Md	20%
Echinochloa colonum subsp. edulis (Honda) Banfi & Galasso	Shyamaka	Jhangora	Poaceae	Gr	UN	Md, Ed, Fd	40%
Ficus benghalensis L.	Vat	Banyan	Moraceae	T	C	Md, Ot	10%
Ficus palmata Forssk.	-	Bedu	Moraceae	T	C	Ed, Md	30%
Ficus religiosa L.	Plaksa	Pepal	Moraceae	T	C	Md, Ot	10%
Gentiana kurroo Royle.	Trayanthi,	Triman	Gentianaceae	H	UN	Md	10%
Grewia optiva J.R.Drumm. ex Burret.	Dhanvanah	Bheemal	Malvaceae	T	C	Ed, Fo, Fu, Md	70%
Hedychium spicatum Sm.	Shathi, Gandhamulika	Kapoor kachri	Zingiberaceae	H	UN	Md	10%
Hypericum perforatum L.	-	Coli-phulya	Zingiberaceae	H	C	Md	20%
Indigofera heterantha Wall. ex Brandis		Saakina	Rosaceae	H	C	Md, Ed, Fu	40%
Juglans regia L.	Akshota	Akhrot	Juglandaceae	T	C	Ed, Md, Ti,	40%
Lyonia ovalifolia (Wall.) Drude		Anyar	Ericaceae	T	UN	Md, Fd	60%
Mangifera indica L.	Aamra	Aam	Anacardieaceae	T	C	Md ,Ed,Ot	30%
Mentha longifolia (L.) L.	-	Pudina	Lamiaceae	H	C	Md, Ed	30%
Mirabilis jalapa L.	Krishnakeli	-	Nyctaginaceae	H	C	Md, Ed	20%
Myrica esculenta Buch.-Ham. ex D.Don	katphala, mahavalkala	Kaphal	Myricaceae	T	UN	Ed, Fu, Md	60%
Myrsine africana L.	Vidanga	Banwan	Primulaceae	S	UN	Md	10%
Nyctanthes arbor-tristis L.	Parijata	kurri	Oleaceae	T	C	Md	10%
Ocimum tenuiflorum L.	Tulasī, Surasā	Tulsi	Lamiaceae	S	C	Md, Ed	20%
Origanum vulgare L.	Maruvaka	Ban tulsi	Lamiaceae	H	UN	Md ,Ed	20%
Oxalis corniculata L.	Amlapatrika,	Bhilmori	Oxalideaceae	H	C	Md , Ed	20%
Paspalum scrobiculatum L.	-	Koda	Poaceae	Gr	UN	Md, Ed, Fd	50%
Phyllanthus emblica L.	Amalaki	Avola	Phyllanthaceae	T	UN	Md, Ed	20%
Pinus roxburghii Sarg.	sarala	Chir	Pineaceae	T	C	Md , Ed, Fu	60%
Potentilla fulgens Wall. ex Sims	kanthamuna	Bajradantti	Rosaceae	H	UN	Md	70%
Potentilla indica (Andrews) Th.Wolf	-	Kiphaliya	Rosaceae	H	C	Ed , Md	30%
Pouzolzia rugulosa (Wedd.) Acharya & Kravtsova	-	Daar	Urticaceae	T	UN	Md	20%
Prinsepia utilis Royle	-	-	Rosaceae	S	C	Md ,Ol	20%
Pyracantha crenulata (D.Don) M.Roem.	-	Ghingar	Rosaceae	S	UN	Md, Ed	30%
Pyrus pashia Buch.-Ham. ex D.Don	-	Mole	Rosaceae	T	C	Ed, Md	30%
Reinwardtia indica Dumort.	-	phiyoli	Linaceae	H	C	Md, Ot	30%
Rhododendron arboreum Sm.	Kurvak	Buraas	Ericaceae	T	UN	Md, Ed,	60%
Rubia cordifolia L.	Manjistha	Manjith	Rubiacea	Cl	UN	Md	40%
Rubus ellipticus Sm.	-	Hisar	Rosaceae	S	C	Ed, Md	30%
Rubus mesogaeus var. mesogaeus		Kali hissar	Rosaceae	S	UN	Ed, Md	30%
Rumex hastatus D.Don	-		Polygonaceae	H	C	Md	20%
Rumex nepalensis Spreng.	-	kholiya	Polygonaceae	H	C	Md, Ed, Fo	20%
Sapindus mukorossi Gaertn.		Reetha	Sapindaceae	T	UN	Md	30%
Searsia parviflora (Roxb.) F.A.Barkley	-	Tungla	Anacardiaceae	T	C	Md	40%
Setaria italica (L.) P.Beauv.	musati	Koni	Poaceae	Gr	C	Md, Ed, Fo	50%
Skimmia laureola (DC.) Decne.	-	Kedarpatti	Rutaceae	S	UN	Md	10%
Smilax aspera L.	-	Ram – datun	smilacaceae	Cl	UN	Md	20%
Smilax rotundifolia L.	-	Ram – datum	smilacaceae	Cl	UN	Md	10%
Solanum nigrum L.	Kakamachi,	-	Solanaceae	H	C	Md	10%
Taraxacum officinale	Dugdhapheni	Kadvi ghass	Asteraceae	H	C	Md	10%
Taxus baccata L.	Manduparni	Thuner	Taxaceae	T	UN	Md	50%
Tinospora sinensis (Lour.) Merr.	Amrta Vatsadani	Giloy	Manisoermaceae	Cl	C	Md	30%
Urtica dioca L.	Vrscikali	kandali	Urticaceae	S	C	Ed, Md	50%
Viola canescens Wall.	-	Banaspa,	Violaceae	H	C	Md	10%
Woodfordia fruiticosa (L.) Kurz.	Subhiksha	Dhalua	Lythraceae	S	C	Md, Fu	20%
Zanthoxylum armatum DC.	Tejohva	Timaru	Rutaceae	S	C	Md	40%
Ziziphus mauritiana Lam.	Karkandhu	Ber	Rhamnaceae.	S	C	Md, Ed	20%

Abbreviation- H = Herb; S = Shrub; T = Tree; Cl = Climber; Fn = Fern; Gr = Grasses; C = Common; Un = Uncommon; Md = Medicinal; Ed = Edible; Fu = Fuel; Ti = Timber; Ot = Other; Fd = Fodder and Oi = Oil

The distribution of species in ten categories of TIV%, maximum species recorded in 11–20% (17 spp.), followed by 21–30% (15 spp.), 1–10% (13 spp.) and 31–40% (9 spp.) while none of the species showed TIV above 70% **(**Fig. 2). The TIV analysis showed that trees have the highest socio-economic value (TIV 10–70%) to inhabitants than other life forms (shrubs, herbs, climbers) because trees are the only source of timber, and fuel wood value besides being used for fodder and medicine (Rawat, 2016). Tree species such as *Lyonia ovalifolia, Myrica esculenta, Pinus roxburghii, and Rhododendron arboreum* have a higher TIV (Total Importance Value) at the study site. (Rawat et al. 2018). Trees have a high socioeconomic importance because they are the primary source of timber, fuel wood, and fodder, and they are also used for medicinal purposes (Samant *et al.,* 2007; Singh & Gaur, 2008). Tree species such as *Lyonia ovalifolia, Myrica esculenta, Pinus roxburghii, and Rhododendron arboreum* have a higher TIV (Total Importance Value) at the study site. (Rawat et al. 2018). Trees have a high socioeconomic importance because they are the primary source of timber, fuel wood, and fodder, and they are also used for medicinal purposes (Samant *et al.,* 2007; Singh & Gaur, 2008). As per Table 1, species such as *Rhododendron arboreum, Pinus roxburghii, Cedrus deodara*, and *Myrica esculenta* are the most preferred at the study site, mainly due to their availability. Among shrubs, *Berberis asiatica* is the most preferred species, showing the maximum TIV due to its various uses, such as medicine, edible, and fuel. The herb species *Potentilla fulgens* has a higher TIV in the area due to its medicinal value and its availability in some specific areas. *Diplazium esculentum*, a fern species, has a TIV of 70%.

In order to reduce the dependence on forests, it is necessary to give knowledge to villagers on planting trees that mature quickly in degraded and unarable lands. It is important to avoid overgrazing and extensive lopping in forests to allow for their regeneration within a short period. Prioritising these species for conservation and plantations, their TIV value is higher. This step is crucial because human settlements often cause deforestation and damage to nearby forests. By reducing the pressure on these forests, we can help preserve them for future generations, maintain biodiversity, and mitigate the effects of climate change.

ACKNOWLEDGEMENTS

The authors extend their gratitude to the local inhabitants for their generous time and knowledge sharing during the study.

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