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Domestication of some wild medicinal plants in Upper Johar Valley, Kumaun Himalayas

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Abstract
The present study, shedding light on domestication of wild medicinal plants of Upper Johar Valley, Pithoragarh district Kumaun Himalayas suited in the central Himalayan range. A field survey was conducted during the rainy season 2023 in all the thirteen villages of Upper Johar Valley (Pithoragarh). This region is situated between 3000m to 3500m altitude (ASL). A total of 18 plant species, belonging to 13 families and 15 genera domesticated by locals in their fields to cure various diseases such as diabetes, fever, stomach ache, snakebite, hair loss, etc. Statistical analysis has revealed that *Allium stracheyi* Baker is the most useful plant (UV=0.9873) followed by *Carum carvi* L. (UV=0.8987), *Angelica glauca* Edgew. (UV=0.8860) and *Rheum australe* D. Don (UV=0.7088). Similarly Informants Consensus Factor (ICF=1) showed maximum homogeneity occurring in the information for anti-diabetic, respiratory, gynecological, hair fall, cough and cold. Fidelity level, for the most frequently reported by the informants, highest for cough and cold (88.6075), followed by Gastrointestinal (86.0759), joint pain and fracture (74.6835).

Keywords: Domestication of medicinal plants, Johar valley, indigenous knowledge, over-exploitation

Introduction

Johar is one of five valleys in the central part of the Himalayas of Uttarakhand. They are Byans, Chaundas, Darma and Johar, going east to west. Two more valleys Niti and Vishnuganga are located in Johar west (Kak 2001) [4]. Johar valley situated in the upper Gori Ganga catchment of Pithoragarh district Uttarakhand is a part of Indian Himalaya shares an immense view of Nandadevi parvat covers a total geographical area of 52.7km2 and lies between latitude of $30^0 30`$ N and latitude $80^0 10`$ E is home to many flora and fauna which hold a great component of Indian biodiversity. The valley is surrounded by many high-peak mountains with different altitudinal ranges and shares different vegetative habitats from grassland slopes to herbaceous meadows or Bugyals. Johar valley is the second-largest valley in the Kumaun Himalaya (Yadav 2022) [11]. The massive Milam glacier, located close to the Tibetan border, is the source of the Gori Ganga River. At the foot of the Milam glacier, where the vast and expansive village of Milam is located (Chatterjee, 1976) [2]. Milam is an ideal location for connecting with nature, making it a perfect destination for many enthusiastic trekkers. During September - October valley is in its peak glory; make it the ideal time to visit. Herbaceous plants with brightly colored flowers or glasses cover the entire valley and make it even more magnificent for visitors to determine such heavenly on earth scenery.

The significance of ethnomedicinal plants, their domestication efforts, and their availability for production, conservation, and development are all summed up in this paper.

Materials and Methods

Study area: The present study was conducted in the Upper Johar valley of Kumaun Himalayas. The area is unexplored particularly for the vegetation profile. A field survey was conducted during 2023 in a total of 13 villages, namely Laspa, Rilkote, Tola, Mapa, Bilju, Burfu, Lwa, Khilach, Sumatu, Ganghar, Paachu, Martoli and Milam, of Upper Johar Valley (Figure 1). The region is located from 3000m to 3500m altitude (ASL). The Bhotiya tribe is one of the dedicated societies of the region practicing seasonal and altitudinal migration from lower regions to Upper Johar for only 6 months (May-October) every year for centuries. They traditionally rely on medicinal and aromatic plants and use them for traditional healthcare and livelihood. The Upper Johar region is an abode of the occurrence of various medicinal and aromatic plants. Most of the region is covered under alpine zone. Therefore, only dwarf tree species and bushy vegetation was found there.

Field survey and data collection: To gather information on therapeutic plants that the locals in the area have domesticated, ethnobotanical surveys were conducted from May-October 2023. A semi-structured questionnaire was prepared, through face-to-face interviews to collect ethnomedicinal data. Plants specimens collected from different sites of the study area. Demographic data, such as name of the person, age, gender, occupation, place, and ethnomedicinal information about the plants such as local name, habitat, and method of utilization, etc were recorded during field visits.

Plant identification: Identification was done using established methods by Jain and Rao (1997) following a record of the collecting of plants materials, drying, mounting, preparation, and preservation of plant specimens. The plant species collected during the survey were placed alphabetically by scientific name, family name, local name and ethnomedicinal uses. These plant specimens were identified using the standard flora available in this area Flora of Pithoragarh by G. S. Rawat *et al.* (1998), Flora of central and south eastern parts of Pithoragarh by S.S. Samant (1998), and similar altitudinal regions like, Plant of Kedarnath Wildlife Sanctuary, western Himalaya by I. D. Rai *et al.* (2017) [6]. Further taxonomic names of plant

species were confirmed at resources from the online database namely: e-flora of India (https://efloraofindia.com/), and the Kew Botanical Garden Medicinal Plants Name services (https://powo.science.kew.org/results?). Voucher specimens were deposited in the Biodiversity Conservation Laboratory, Department of Botany, Soban Singh Jeena University Almora, Uttarakhand, for future reference.

Data analysis: During the field survey a total 79 interviews were conducted. The collected data contains detailed ethnobotanical information that was analyzed with the help of quantitative statistical indices such as Informants consensus factor (Trotter and Logan, 1986) [10], Use vale (Phillips and Gentry, 1993) [5], and Fidelity level (Alexiades, 1996) [1].

Informant's consensus factor (ICF)

Informant's consensus factor estimates the variability of medicinal plants and the level of homogeneity of information provided by different informants. (ICF=1) showed maximum homogeneity occurring in the information.

$$\text{Informant Consensus Factor} = Nur - Ns / Nur - 1$$

Where, Nur = number of use report for a particular ailment category; Ns = number of species used for the same category by all the informants (Trotter and Logan, 1986) [10]

Fidelity level (FL)

Fidelity level is the percentage of informers aiming the use of a certain plant species for the same major purpose, will be calculated for the most frequently reported diseases or ailments as

$$\text{Fidelity level (FL) (\%)} = Np / N * 100$$

Where, Np = Citation for particular diseases (use report); N = Total informants (Alexiades, 1996) [1].

Use value (UV)

The use value determines which plants are the most useful for medicine in a community. It helps to understand how many times people use a certain plant to treat different illnesses.

$$UV = \Sigma UN / N$$

Were, UN= Total number of times people reported using a plant to treat different illness; N= Total number of people reported (Phillips and Gentry, 1993) [5].

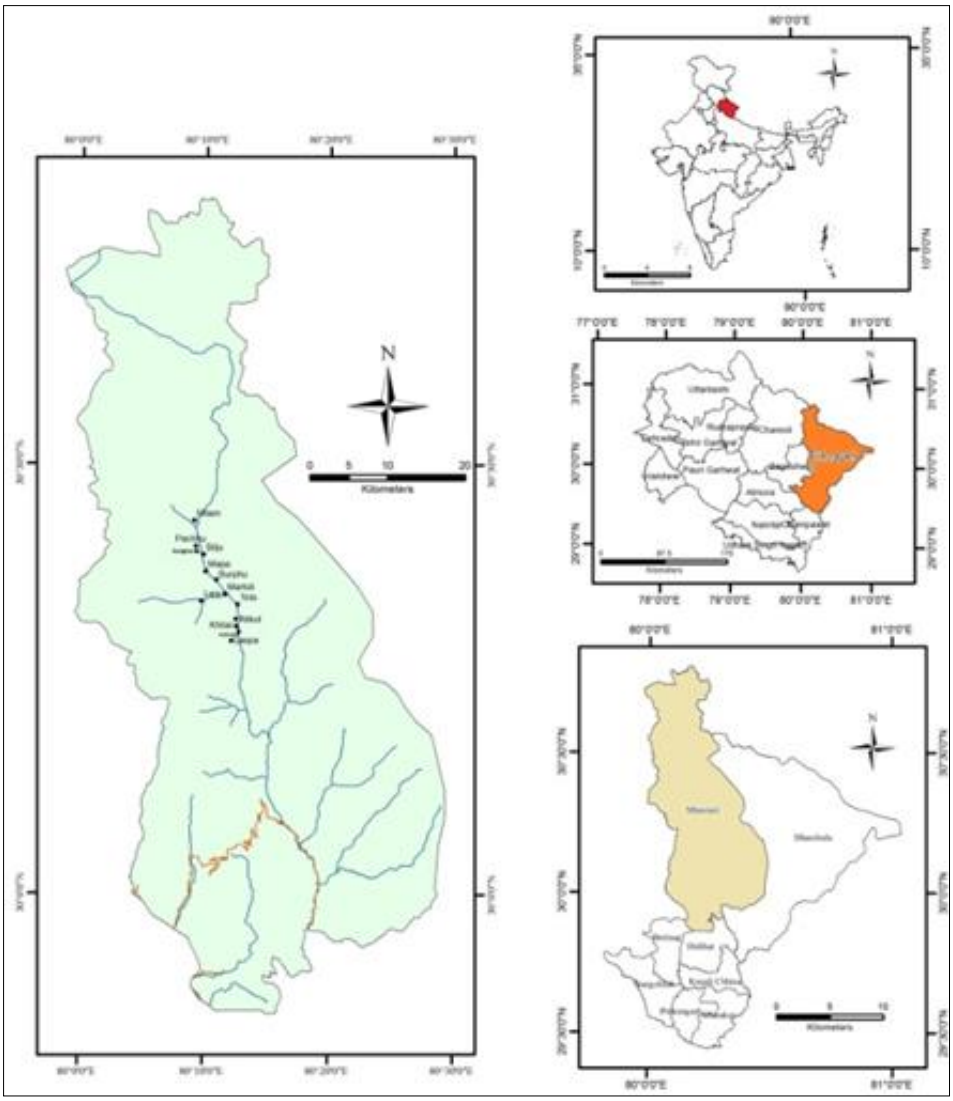

Fig 1: Location map of the study area

Fig 2: Data collection during field visits

Result and discussion

Demographic status: Historically, the British government gave the name Bhotiya in 1967 because of currency, social and cultural peculiarities and the community was declared in the Scheduled tribe category by the government of India. The seventh decade of the twentieth century witnessed the Shauka community of Johar transitioning due to the historical India-China border dispute taking shape, leading to the cessation of Tibet trade in 1962 and the abolition of Zamindari in 1965, as per the tradition of the marginal residents of Uttarakhand.

Due to the transfer of the land to the tenants by the government of India, the economic structure of life of the people of Johar was shattered. Although after the country's independence the government of India was making efforts for the economic development and social upliftment of this region, the new culture here (Pangati 1992) [9]. The Bhotiya tribe includes Darmiya, Jyasi, and Chaudasi of Dharchula, Tehsil and Johari of Munsiyari Tehsil of Pithoragarh district. Besides, some tribes of Tolcha, and Marchha of Chamoli district, Jad of Uttarkashi and Khampa of Tibet have also been included in the Bhotiya tribe (Pangati 1992) [9]. Still the tribe is struggling for their socio-economic and sustainable development in the region. During the present study, about 79 people of the Bhotiya tribe were interviewed, of which 51 (64.6%) were male and 28 (35.4%) were female. All the informants were categorized into four age groups: (i) 20-40 years, (ii) 41-60 years, (iii) 61-80 years, (iv) 81 years above. Out of the total 79 informants, maximum fell under the second group (31 people 39.2%), followed by the third group (28 people 35.4%), first group (17 people 21.5%), and fourth (03 people 3.8%). They were mainly engaged in agriculture, animal husbandry, and tourism.

An account of ethno-medicinal plants of the study area: During the present study, a sum of 18 medicinal plant species belonging to 15 genera of 13 families were found domesticated by tribe in their cultivated land at upper Johar valley. All these plants are used for the treatment of various ailments. People in the region harvest different plant parts for the preparation of traditional remedies, e.g., roots, seeds, leaf, flower, and even whole plant. Roots were recorded as the prominent plant part (66.7%) followed by leaves (16.7%) and flowers, seeds, and whole plants about 5.6%. The most dominant family was Apiaceae, with its three plant species, followed by Amaryllidaceae, Polygonaceae and Ranunculaceae each with two plant species.

Besides, some land races cash crops of the area such as *Fagopyrum esculentum* (Oogal), *Fagopyrum tartaricum* (Phaphar), two species of barley- *Hordeum vulagare* (Uwa), *Amaranthus frumentaceous* (Chaulai), *Phaseolu vulgaris* (Rajma), *Pisum sativum* (Mattar), and *Solanum tuberosum* (Aalu) are also grown by this community for their economic upliftment (Silori, *et al*., 2000) [8].

Utilization pattern of ethno-medicinal plant

Three statistical indices: Informants consensus factor, use value, and fidelity level were applied for analysis to investigate the collected data. Informant's consensus factor determines the homogeneity and heterogeneity of information for a particular disease category. A higher ICF (close to 1) indicates that a particular plant species is commonly used by informants for a specific ailment category. Maximum homogeneity (ICF=1) was observed in the information regarding antidiabetic, respiratory, gynecological, hair fall, cough, and cold. This data is presented in Table2.

The use value was categorized into three levels: (i) least (0.01-0.07), (ii) moderate (0.08-0.5), (iii) highest (0.6-1). The maximum seven species fell under least condition. It was followed by six species of moderates. The highest use value, about 0.9873 was calculated for *Allium stracheyi*, followed by *Carum carvi* (0.8987), *Angelica glauca* (0.8860), and *Rheum australe* (0.7088). This information is presented in Table 1.

Table 1: Ethnomedicinal uses of documented plants species

S. No	Botanical name	Local name	Habit	Part used	Method of utilization	Use value
1.	*Aconitum ferox* Wall. ex Ser. [Ranunculaceae]	Metha bish	Herb	Root	Use root paste for snake bites.	0.0632
2.	*Aconitum heterophyllum* Wall. ex Royle. [Ranunculaceae]	Atees	Herb	Root	Use of roots for fever, stomach ache, and diarrhea.	0.3797
3.	*Allium stracheyi* Baker. [Amaryllidaceae]	Jambu	Herb	Leaf	Used for stomach ache, gastritis, joint pain, and as food.	0.9873
4.	*Allium wallichi* Kunth. [Amaryllidaceae]	Jangali Lashun	Herb	Leaf	Used for stomach ache and as food.	0.0126
5.	*Angelica glauca* Edgew. [Apiaceae]	Chippi	Herb	Root	Consumption of roots for Gastritis, Cough and Cold.	0.8860
6.	*Arnebia benthamii* Wall. ex G.Don	Lal jari	Herb	Root	Applied for hairfall, baldness mixed with	0.1898

	[Asparagaceae]				oil, and food color.	
7.	*Carum carvi* L. [Apiaceae]	Kala jeera	Herb	Seed	Tonic for stomach ache and as food	0.8987
8.	*Chaerophyllum villosum* Wall. ex DC. [Apiaceae]	Ganjari	Herb	Root	Suitable for respiratory diseases and Immunity booster.	0.0759
9.	*Dactylorhiza hatagirea* D. Don [Orchidaceae]	Hathi jari	Herb	Root	Boiled roots to treat leukorrhea and immunity booster.	0.3291
10.	*Humulus lupulus* L. [Cannabinaceae]	Himhops	Herb	Flower	Used for stomach ache and as a brewage.	0.0506
11.	*Nardostachys jatamansi* DC. [Caprifoliaceae]	Maasi	Herb	Root	Used as incense, treat rheumatism and epilepsy.	0.0886
12.	*Picrorhiza kurroa* Royle ex. Benth [Plantaginaceae]	Kutki	Herb	Root	Root solution for fever, jaundice, diabetes.	0.3924
13.	*Podophyllum hexandrum* T. S. Ying [Berberidaceae]	Vankakri	Herb	Root	Root paste on cuts, wounds, and skin diseases.	0.0506
14.	*Rheum australe* D. Don [Polygonaceae]	Dolu	Herb	Root	Root paste for bone fracture and joint pain.	0.7088
15.	*Rheum moorcroftianum* Royle [Polygonaceae]	Tanturi	Herb	Root	Consumption of roots for stomach problems and application of paste for wounds, cuts and boils.	0.0253
16.	*Saussurea costus* (Falc.) Lipsch [Asteraceae]	Kuth	Herb	Root	For treating jaundice, toothache, itching, snakebite and color.	0.6075
17.	*Swertia chirata* (Wall) C. B. Clarke [Gentianaceae]	Chirata	Herb	whole	Consumption of juice in case of fever, stomach ache, and diabetes.	0.3797
18.	*Urtica dioica* L. [Urticaceae]	Bichu	Herb	Leaf	Used for treating sprained ankles, reduces blood pressure, blood sugar and is consumed as food.	0.0126

Fidelity level (Figure3.) will be calculated for the most frequently reported by the informants highest for cough and cold (88.6075), followed by Gastrointestinal (86.0759), joint pain and fracture (74.6835). This information is presented in Table2.

Table 2: Informant consensus factor (ICF) and Fidelity level (FL) for various disease categories

S.No.	Disease Category	No of use reports (Nur)	No. of species used (Nt)	ICF	Fidelity level (%)
1.	Anti-diabetic	30	1	1	37.9746
2.	Cough and cold	70	1	1	88.6075
3.	Cuts and wounds	28	2	0.9629	35.4430
4.	Fever and headache	43	6	0.8809	54.4303
5.	Gastrointestinal	68	6	0.9253	86.0759
6.	Immunity booster	25	2	0.9583	31.6455
7.	Joint pain and fracture	59	3	0.9655	74.6835
8.	Respiratory	6	1	1	7.5949
9.	Gynecological	26	1	1	32.9113
10.	Hair fall	15	1	1	18.9873

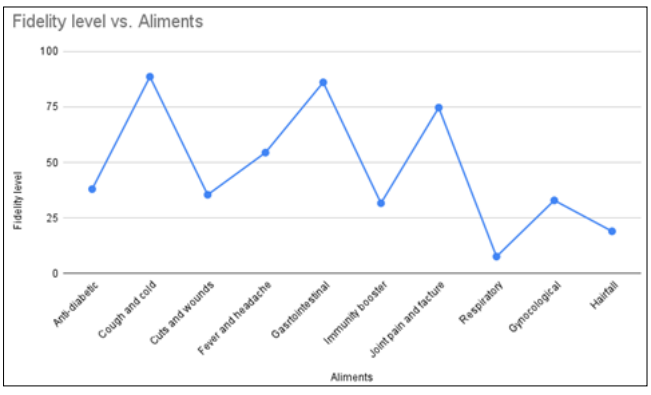

Fig 3: Fidelity Levels by Ailment Line Chart

Local community trends to be well knowledgeable about the ecology and application of plants in the region. Present study incorporates documentation of ethnomedicinal, these plants occurred naturally in large quantities in the region. Unfortunately, over exploitation has resulted in a limited number of natural yields of these plants in the region. As a substitute, the local community has started domesticating 18 valuable medicinal plants as alternative sources. These plants also possess various medicinal compounds, and their market price is also high. Thus, on one hand, these selected medicinal plants will enhance the livelihood of these people; on the other hand, due to the cultivation (domestication) of these important medicinal plants, there will be a control on over-exploitation in their natural habitat.

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References

1. Alexiades MN. Collecting ethnobotanical data: an introduction to basic concepts and techniques. Advances in economic botany,1996:10:53-94. https://www.jstor.org/stable/43927611
2. Chatterjee BB. The Bhotias of Uttarakhand. India international centre quarterly,1976:3(1):3-16. doi:10.2307/23001864
3. Jain SK, Rao RR. A handbook of field and herbarium methods, 1979.
4. Kak M. Those who once walked mountains. India International Centre Quarterly,2001:27:177-192. https://www.jstor.org/stable/23005709

5. Phillips O, Gentry AH. The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany, 1993, 15-32. https://www.jstor.org/stable/4255479
6. Rai ID, Singh G, Rawat GS. Plants of Kedarnath Wildlife Sanctuary, Western Himalaya: A Field Guide. Bishen Singh Mahendra Pal Singh, 2017. https://doi.org/10.16943/ijhs/2018/v53i2/49430
7. Samant SS. Flora of central and south eastern parts of Pithoragarh district. *Vol. I & II. Ph. D.* Thesis submitted to Kumaun University, Nainital, 1987.
8. Silori CS, Badola R. Medicinal plant cultivation and sustainable development. Mountain Research and Development,2000:20(3):272-279. https://doi.org/10.1659/0276-4741(2000)020[0272:MPCASD]2.0.CO;2
9. Pangati SS. The Bhotiya tribe of the central Himalayas, 1992.
10. Trotter RT III, MH Logan. Informant consensus: A new approach for identifying potentially effective medicinal plants. In Plants in indigenous medicine and diet: Biobehavioral approaches, ed. N. L. Etkin. Bedford Hills, NY: Redgrave, 1986, 91–111.
11. Yadav K, Rajput P, Agnihotri P. Ethnomedicinal Plants from Milam Valley of Uttarakhand, India, 2022.