RESEARCH ARTICLE

Diversity and Utilisation Pattern of Wild Edible Plant Resources in the Jaunpur Block of Tehri Garhwal District, Uttarakhand, India

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Abstract

Wild edible plants serve as a valuable resource, offering not only supplementary nourishment but also constituting a significant component of staple meals and providing a potential source of income for the communities. A comprehensive survey of Jaunpur Block has been done in different seasons in a year (2022-23) to assess the diversity and uses of wild edible plants. Jaunpur Block lies between latitudes 30°25.00'–30°33.00'N and longitudes 78°3.00'–078°15.00'E, characterised by different altitudinal gradients, 1100 –2100 amsl. The survey was carried out with questionnaires and in-person interviews in both Hindi and the local dialect (Garhwali). We reported 68 wild edible plant species belonging to 59 genera and 38 families. Among 38 families, the maximum species were recorded in Rosaceae (10 spp.). The analysis of life forms showed that a major proportion of species were trees (23 spp., 33%), followed by herbs (21 spp., 32%), shrubs (17 spp., 25%), climbers (3 spp., 4%), grass (3 spp., 4%), and Fern as *Diplazium esculentum* (Retz.) Sw. (1sp., 2%). The study emphasizes the critical role these plants play in local diets and food security, especially during periods of scarcity. It also addresses concerns about the sustainability of certain species facing anthropogenic pressures, advocating for community engagement and conservation efforts. The findings underscore the rich biodiversity of the region and the importance of wild edible plants in supporting the livelihoods and food security of local communities.

Keywords: Ethnobotanical, Garhwal, Jaunpur, Mussoorie, Wild edible.

Highlights

- The study identified 68 wild edible plant species across 59 genera and 38 families in the Garhwal Himalaya, highlighting the region's rich biodiversity.
- In 38 families, the maximum species were recorded in the Rosaceae (10 spp.) Family.
- A total of 593 informants, of which 362 (61%) of the informants were male, and 231 (39%) were female.
- The analysis of life forms showed that a major proportion of species were trees, followed by herbs, shrubs, climbers, grass, and ferns.
- The analysis revealed that fruits were the most commonly used, with 29 species, followed by leaves with 25 species. The least utilized parts included bulbs, fronds, and tubers, each with only 1 species.

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Introduction

The historical importance of wild edible plants as a vital component of human sustenance is particularly pronounced in rural India, where a considerable segment of the population relies on these plants to fulfil supplementary dietary needs (Khyade *et al*., 2009). Beyond providing nutritional diversity to family diets, the diverse range of wild plant species significantly contributes to household food security, presenting an alternative to diets predominantly centered around a limited set of cultivated crops (Prescott-Allen and Prescott-Allen, 1990; Bussmann, 2006). In the Garhwal Himalaya, the vibrant tapestry of biodiversity unfolds a rich array of wild edible plants that have been integral to the lives of the local communities for generations (Agarwal and Chandra 2019). Wild edible plants emerge as crucial contributors to dietary needs, especially during periods of food scarcity for local inhabitants (Tiwari *et al*., 2010). Wild Edible Fruits (WEFs) are naturally occurring, uncultivated fruits that play a vital role in the diet, nutrition, and cultural practices of indigenous communities. These fruits contribute to biodiversity conservation, food security, and economic stability, aligning with several United Nations Sustainable Development Goals (SDGs) Khanduri *et al.* (2025).

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Residents in the rural Himalayan regions rely extensively on diverse biological resources to sustain their livelihoods, with primary economic support stemming from animal husbandry and marginal agriculture (Kala, 2005 and 2007). 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). We navigate the complexities of modern food systems and face challenges such as climate change and resource depletion. The rediscovery and appreciation of wild edible plants offer a path towards a more resilient and diverse food culture. This exploration not only reconnects us with our culinary heritage but also highlights the importance of ecological stewardship in maintaining the delicate balance between humans and the natural world.

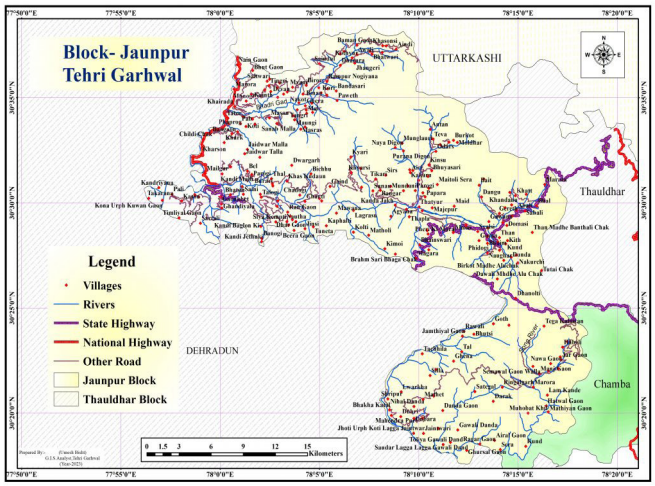
In many regions of India, especially in the Garhwal Himalaya, the rural population depends heavily on wild plants to supplement their dietary needs. Several studies (Maikhuri *et al.,* 2000; Kala, 2007; Dhyani *et al.,* 2007; Radha *et al.,* 2013; Butola and Hareesh, 2018; Thakur *et al.,* 2020) have highlighted the diversity and traditional uses of wild plants from this region. Tiwari *et al.,* (2010) emphasized the significance of wild plants in the diet of the rural population. This traditional practice of consuming wild edibles is deeply ingrained in the food habits of rural societies, playing a significant role in various aspects of their socio-cultural, spiritual life, and overall health (Singh, 2006). The diverse range of wild plant species available offers essential dietary diversity for families, contributing significantly to household food security and meeting the nutritional requirements of the rural population throughout the year, as reported by Sundriyal and Sundriyal (2003).

The unique topography, vegetation, people, and traditions of the Garhwal Himalaya region make forest resources crucial to the livelihoods of local communities. Despite small land holdings and subsistence agriculture, the local people continue to rely on natural forest resources for sustenance, gathering various plants for food, medicine, fodder, fuel, timber, and agricultural implements. Notably, wild edible plants play a particularly important role as food supplements during times of scarcity for the local inhabitants. Having a comprehensive knowledge base that includes detailed information about a wide range of wild edible plants is crucial for effectively identifying areas that require additional research and for prioritizing future research needs. Understanding the importance of having a thorough and synthesized database of information on wild edible plants, this paper aims to thoroughly review and analyze the existing diversity of wild edibles and patterns of utilization in the Jaunpur block of Tehri, located in the Garhwal Himalaya region. This review will encompass various aspects such as species diversity, traditional uses, ecological significance, and potential cultural and economic impacts of wild edible plants in the region.

Materials And Methods

Study Site

The study was conducted in the Jaunpur Block, Tehri Garhwal, Uttarakhand. It lies between latitudes 30°25.00′–30°33.00′N and longitudes 78°3.00′–078°15.00′E, characterised by different altitudinal gradients, 1100–2100 above mean sea level. The climate is temperate due to altitudinal variation. November to February is the coldest Month, and July is the hottest. The rainfall is recorded to be the highest from July to September (Fig. 1).



https://tehri.nic.in/block-maps/

Fig.1: Jaunpur Block, Tehri Garhwal, Uttarakhand

Demography of the study site

The Jaunpur block is situated in the Tehri Garhwal district of Uttarakhand. It comprises 259 villages and a total of 12,066 households. The overall population of the Jaunpur block is 72,219, with 36,155 males and 36,064 females, resulting in a nearly equitable gender ratio of approximately 1,003 males for every 1,000 females. Among the population, 268 individuals belong to the Scheduled Tribes (ST), while 13,574 individuals are from the Scheduled Castes (SC). The block has a literacy rate of 75.45%, with approximately 54,478 literate individuals. The average household size is around 6 members, and children aged 0-6 years make up 15.20% of the population, totalling 10,980 young individuals (Census, 2011).

Data collection

A thorough survey was carried out in Jaunpur Block throughout the year, ww interviews in both Hindi and the local Garhwali dialect to capture ethnobotanical information, including local names, uses, and the specific plant parts utilized. To ensure the accuracy of the collected specimens, they were meticulously identified and processed using standard herbarium techniques as outlined by Jain and Rao (1977). Additionally, the specimens

Table 1: Representing the demography of informants

Attribute	*Groups*	*Number*
Gender	Male	544
	Female	349
Age	18-30	133
	30-40	267
	40-50	394
	50-60	68
	Above 60	31
Occupation	Farmer	749
	Government Job	145

Table 2: Diversity of wild edible plants in Jaunpur Block

Sl. no	*Botanical name*	*Vern. Name*	*Family*	*Season*	*L.F*	*P.U.*	*Uses*
1	*Amaranthus viridis L.*	Jugali chaulai	Amaranthaceae	Al	H	Lv	Leaves are used for making vegetables.
2	*Aegle marmelos (L.) Corrêa*	Bel	Rutaceae	May-June	T	Fr	Ripe fruit eats.
3	*Amaranthus caudatus L.*	Chaulai	Amaranthaceae	Al	H	Lv, Sd	Leaves are raw or cooked as vegetables and seeds are used for making flour and laddu.
4	*Amaranthus hypochondriacus L.*	Chaulai	Amaranthaceae	Al	H	Lv, Sd	Leaves are raw or cooked as vegetables and seeds are used for making flour and laddu.
5	*Berberis aristata DC.*	-	Berberidaceae	March-May	S	Fr	The plant produces bunches of succulents and acidic, edible berries.
6	*Berberis lycium Royle*	-	Berberidaceae	March-May	S	Fr	Ripe fruit was directly consumed.
7	*Phanera vahlii (Wight & Arn.) Benth.*	Malu	Fabaceae	Sep- Nov	Cl	Fr	Ripe fruit was directly consumed.
8	*Bauhinia variegata L.*	Guriyal	Fabaceae	Mar – Apr	T	Bd, Pt	Bud is used as a vegetable and petals are used as making ryta and paratha.
9	*Bergenia ciliata (Haw.) Sternb.*	Silpari	Saxifragaceae	April-June	H	Lv	Dried leaves are used with tea.
10	*Pouzolzia rugulosa (Wedd.) Acharya & Kravtsova*	Daar	Urticaceae	Aug- Sep	T	Bk	The bark was used as juice exertion.
11	*Bombax ceiba L.*	Semal	Malvaceae	Fab- Mar	T	Fl	Flower buds were cooked as a vegetable.
12	*Cassia floribunda Car.*	-	Fabaceae	April-May	S	Pd	Young pods of this plant are edible and eaten as a vegetable.
13	*Celosia argentea L.*	-	Amaranthaceae	Al	H	Lv, Sh	Leaves and young shoots were cooked and used as vegetables.
14	*Celtis australis L.*	Kharik	Cannabaceae	Oct - Nov	T	Fr	Ripe fruit was directly consumed.
15	*Chenopodium album L.*	Bathua	Amaranthaceae	Al	H	Lv	The leaves can be eaten raw or steamed like spinach.
16	*Blitum virgatum L.*	Baithu	Amaranthaceae	Al	H	Lv	Leaves were used as pot vegetable
17	*Cinnamomum tamala (Buch. -Ham.) T. Nees & C.H. Eberm.*	Tej patta	Lauraceae	Apr-May	T	Lv	Leaves were used as condiments.
18	*Cleome viscosa L.*	Jakhya	Cleomaceae	June-Aug	H	Sd	Seeds were used as condiments.
19	*Cornus capitata Wall.*	Tharmol	Cornaceae	June-July	T	Fr	Ripe fruit was consumed directly.
20	*Crotalaria retusa L.*	Rattleweed	Fabaceae	Al	H	Lv	Leaves were used to make vegetables.
21	*Datura metel L.*	Dhatura	Solanaceae	June-Aug	S	Lv, Rt	The leaves and roots were thoroughly crushed and then combined with water. After allowing the mixture to soak for several hours, the liquid needs to be strained before consuming.
22	*Datura stramonium L.*	Bhang	Solanaceae	Jan-July	H	Sd	Seeds were used to make chutney and use as making vegetable gravy.
23	*Dioscorea bulbifera L.*	Genthi	Dioscoreaceae	Dec-Jan	Cl	Bl	Blub boiled as a potato and eaten as a vegetable.
24	*Diplazium esculentum (Retz.) Sw.*	Lingad	Aspidiaceae	Apr-July	Fn	Sh, fd	Young shoots and fronds were used as cooked vegetables.

25	*Drimia indica (Roxb.) Jessop*	-	Asparagaceae	Fab-May	H	Tb, Lv	Tubers are eaten raw or cooked as vegetables. Tender leaves are cooked as vegetables.
26	*Potentilla indica (Andrews) Th. Wolf*	Jangali kafal	Rosaceae	Apr-May	H	Fr	Ripe fruit was edible.
27	*Echinochloa colonum subsp. edulis (Honda) Banfi & Galasso*	Jhangora	Poaceae	Sep-Oct	Gr	Sd	Seeds were used as a substitute for rice.
28	*Ficus auriculata Lour.*	Timala	Moraceae	June -July	T	Fr	The fresh fruit of this plant was consumed as food.
29	*Ficus palmata Forssk.*	Bedu	Moraceae	July	T	Fr	Ripe fruit was edible.
30	*Grewia optiva J.R.Drumm. ex Burret*	Bheemal	Malvaceae	Oct-Nov	T	Fr	Ripe fruit was edible.
31	*Indigofera heterantha Wall. ex Brandis*	Sakina	Fabaceae	Mar- Apr	S	Bd, Pt	Buds were used as cooked vegetables and flowers were used as rayta.
32	*Juglans regia L.*	Akhor	Juglandaceae	June-Sep	T	Sd	Seeds are edible.
33	*Berberis napaulensis var. napaulensis*	Totar	Berberidaceae	Fab- April	T	Fl	Young flowers were used as Chutney.
34	*Mentha longifolia (L.) L.*	pudina	Lamiaceae	Al	H	Lv	Leaves were used a chutney making.
35	*Mirabilis jalapa L.*	-	Nyctaginaceae	June -August	H	Rt, Lv	The root was to make pickles and the leaves were used as vegetables.
36	*Morus alba L.*	-	Moraceae	Jul- Aug	T	Fr	Ripe fruit was consumed directly.
37	*Morus serrata Roxb.*	Mulberry	Moraceae	June - Aug	T	Fr	Ripe fruit was consumed directly.
38	*Remusatia pumila (D. Don) H. Li & A. Hay*	Banpindalu	Araceae	Nov -Jan	H	Fr	Ripe fruit was consumed directly and leaves and tender shoots were used as vegetables.
39	*Bergera koenigii L.*	Kadi patta	Rutaceae	May - Aug	T	Lv	Leaves were used as condiments.
40	*Myrica esculenta Buch. -Ham. ex D. Don*	Kafal	Myricaceae	April-May	T	Fr	The ripe fruit was directly consumed.
41	*Nasturtium officinale W.T. Aiton*	-	Brassicaceae	April-July	H	Lv	Young leaves were cooked as vegetables.
42	*Opuntia stricta (Haw.) Haw.*	Cactus	Cactaceae	Al	S	Pd, Fr	Young pads were cooked as a vegetable and raw fruits were directly consumed.
43	*Oxalis corniculata L.*	-	Oxalidaceae	Al	S	Lv	The leaves were used to give a sour flavour to chutney.
44	*Paspalum scrobiculatum L.*	Koda	Poaceae	Oct- Apr	Gr	Fr	The ripe fruits were consumed directly.
45	*Perilla frutescens (L.) Britton*	Bhangjeera	Lamiaceae	May- July	H	Sd	The cooked seed can be consumed as either millet or rice.
46	*Pinus roxburghii Sarg.*	Chir	Pinaceae	Mar-May	T	Sd	Seeds are used as condiments.
47	*Plantago asiatica subsp. erosa (Wall.) Z. Yu Li*	-	plantaginaceae	July- Aug	H	Lv	The young and tender leaves were suitable for consuming uncooked, while the older and stringier leaves were better suited for being boiled in stews before being consumed.
48	*Persicaria chinensis (L.) H. Gross*	-	Polygonaceae	Aug- Sep	H	Fr	Its fruits are berries and they are edible and sour-tasting.

49	*Potentilla fulgens Wall. ex-Sims*	Bajrdanti	Rosaceae	July- Aug	S	Lv	Leaves were directly consumed.
50	*Prinsepia utilis Royle*	Bhainkal	Rosaceae	May-June	S	Sd, Fr	Seeds were used for oil extrication and fruits were directly consumed.
51	*Prunus cornuta (Wall. ex-Royle) Steud.*	Mehal	Rosaceae	April-June	T	Fr	Raw and ripe fruit was used for consumption.
52	*Prunus persica (L.) Batsch*	Aadu	Rosaceae	April-May	T	Fr	Ripe fruits were directly consumed.
53	*Punica granatum L.*	Aanar	Punicaceae	Aug- Sep	T	Fr	The ripe fruits were consumed directly.
54	*Pyracantha crenulata (D. Don) M. Roem.*	Ghingharu	Rosaceae	June-July	S	Fr	The ripe fruits were consumed directly.
55	*Pyrus pashia Buch. -Ham. ex D. Don*	Mole	Rosaceae	May-June	T	Fr	Ripe fruits were consumed directly.
56	*Rhododendron barbatum Wall. ex G. Don*	Buras	Ericaceae	Jan- Fab	T	Fl, Pt	The flowers were eaten raw with local spices and its petals were used to make juice.
57	*Rosa sericea Lindl.*	Jangali gulab	Rosaceae	April-May	S	Fr	Fruits were edible.
58	*Rubia cordifolia L.*	Makdet	Rubiaceae	Oct- Nov	Cl	Fr	Fruits were directly consumed.
59	*Rubus ellipticus Sm.*	Hisar	Rosaceae	March - April	S	Fr	Fruits were edible.
60	*Rubus leucocarpus Arn.*	Kalyu hisar	Rosaceae	Mar - Apr	S	Fr	Fruits were edible.
61	*Rumex hastatus D. Don*	Almora	Polygonaceae	Apr- June	H	Lv, Sh	Tender young leaves and shoots were used for acid flavour for chutney.
62	*Rumex nepalensis Spreng.*	Kholiya	Polygonaceae	Al	S	Lv, Sh	Tender young leaves and shoots were cooked as a vegetable
63	*Setaria italica (L.) P. Beauv.*	Koni	Poaceae	May- July	Gr	Sd	Seeds were cooked and consumed as either millet or rice and used for making kheer (a sweet dish).
64	*Solanum nigrum L.*	Makoi	Solanaceae	Aug- Sep	H	Fr	Ripened fruits were edible.
65	*Taxus baccata L.*	Thuner	Taxaceae	Sep- Nov	T	Bk	The bark of the plant is utilized as a replacement for traditional tea.
66	*Urtica dioica L.*	Kandali	Urticaceae	Al	S	Lv	Leave was used as a cooked vegetable.
67	*Woodfordia fruticosa (L.) Kurz*	Dhulla	Lythraceae	April-June	S	Fl, Pt	Flowers were directly consumed and flower petals were used as juice exertion.
68	*Ziziphus mauritiana Lam.*	Ber	Rhamnaceae	Oct-Dec	S	Fr	Ripe fruits were consumed directly.

were classified based on the APG IV system classification (Chase *et al.,* 2016), with identification referencing the available literature by Raizada and Saxena (1978).

Results And Discussion

Demography of informants

The informants in this study were chosen to be representative of a diverse cross-section of society, with their demographics categorized by occupation, gender, and age. Out of a total of 893 informants, 544 (61%) were male, and 349 (39%) were female. This data showed that male participation was slightly higher than that of females. Further analysis revealed that 749 interviewees (84%) were engaged in farming, while 145 (16%) were employed in government services, such as teaching and the military. Additionally, the study found that indigenous knowledge is strongly ingrained among the elderly, but seems to be waning in the younger generation of the region. It was also observed that most of the respondents were between the ages of 30 and 50, indicating a predominance of elderly participants (Table 1). This older generation was found to possess more accurate and useful knowledge about natural resources and their diversity when compared to the younger generation.

Diversity

A total of 68 wild edible plant species belonging to 59 genera and 38 families are recorded in the present study. In Table 2, each species' botanical name, family, local name, parts used, and method of usage are listed. For dietary supplements, leaves,

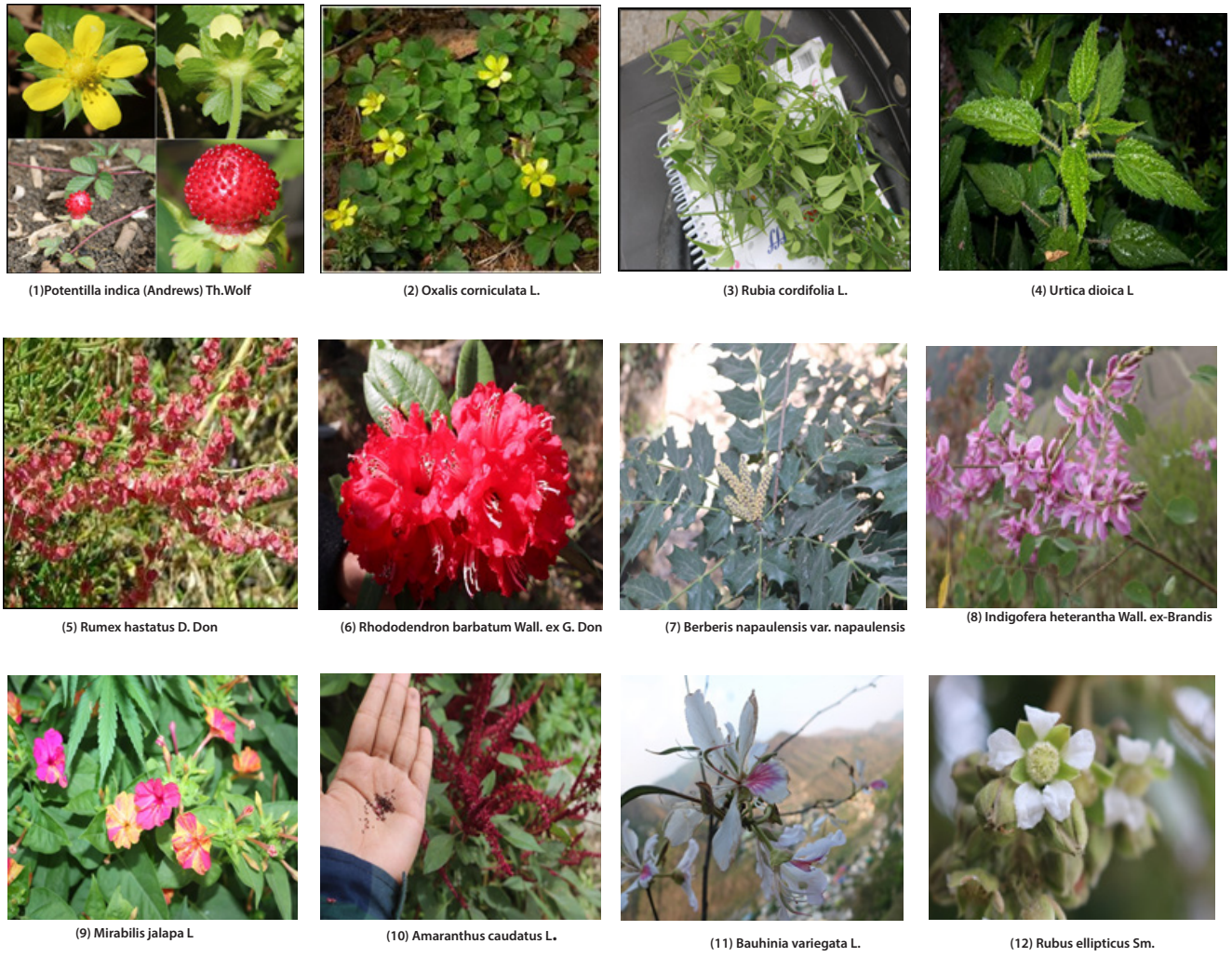


Fig 2: Floral Diversity of the studied site

fruits, tubers, flowers, and whole plants were among the plant parts utilised (Fig. 2). These are used for different purposes by local people. Among 38 families documented, the highest number of species was recorded in Rosaceae (10 spp.), i.e., *Potentilla indica*, *Potentilla fulgens*, *Prinsepia utilis*, *Prunus cornuta*, *Prunus persica*, *Pyracantha crenulata*, *Pyrus pashia*, *Rosa sericea*, *Rubus ellipticus*, and *Rubus leucocarpus*, followed by Amaranthaceae (6 spp.), Fabaceae (5 spp.), Moraceae (4 spp.), Berberidaceae, Poaceae, Polygonaceae (3 spp. each), and Malvaceae, Solanaceae and Urticaceae (2 spp.). Fabaceae, Lamiaceae, Lythraceae, Rutaceae, Araceae, Asparagaceae, Aspidiaceae, Brassicaceae, Cactaceae, Cannabaceae, Cleomaceae, Cornaceae, Dioscoreaceae, Ericaceae, Juglandaceae, Lamiaceae, Lauraceae, Nyctaginaceae, Myricaceae, Oxalidaceae Pinaceae, Plantaginaceae, Punicaceae, Rhamnaceae, Rutaceae, Rubiaceae, Saxifragaceae, Taxaceae (1 sp. each).

Abbreviations: L.F.=Life form; P. U=Parts used; Lv=Leaves; Fr=Fruit; Sd=Seed; Bd=Buds; Pt=etals; Bk=Bark; Fl=Flowers; Pd=Pods; Sh=Shoots; Rt=Root; Bl=Blubs; Fd=fronds; Tb=Tubers; H=Herb; S=Shrub; T=Tree; Cl=Climber; Fern=Fn; Gr=Grass.

The analysis of life forms showed that a major proportion of species were trees (23 spp., 33%), followed by herbs (21 spp., 32%), shrubs (17 spp., 25%), climbers (3 spp., 4%), grass (3 spp., 4%), and Fern (1 sp., 2%). The proportion of edible species was highest among trees, followed in decreasing order by herbs, shrubs, climbers, and ferns. Depending on their availability, different plants and plant components require different amounts of time and frequency to be collected.

The analysis revealed that the majority of parts used were fruits, which accounted for 29 species, making up 35% of the total usage. This was followed by leaves, with 25 species, constituting 21% of the usage. Additionally, seeds were used in 10 species, making up 12% of the utilization. Petals, flowers, and shoots were utilized in 4 species each, comprising 5% of the total usage. Furthermore, bark, pods, and roots were used in 2 species each, accounting for 3% of the total usage. Lastly, bulbs, fronds, and tubers were used in 1 species each, representing 1% of the total usage.

In the study, the research findings highlighted the prevalence of various plant parts in the utilization patterns, with the fruit emerging as the most frequently used part, constituting 32% of the total. The delectable taste of *Myrica esculenta* fruits has sparked a rise in popularity within the town, prompting residents to actively participate in their trade. Likewise, the fruits of Berberis and Rubus have been identified by Chandra *et al*. (2013) as possessing considerable potential for value-added entrepreneurship. This recognition underscores the market desirability and economic prospects associated with these specific fruit types, indicating a burgeoning trend in their consumption and commercial exploitation within the community. Following closely, leaves accounted for 25%, emphasizing their significance in local practices. Seeds were utilized at a rate of 12%. These results provide valuable insights into the preferences and priorities of the local community in the Jaunpur block, Tehri Garhwal, Uttarakhand, shedding light on the diverse roles played by different plant parts in their daily lives. In the context of our study, it is noteworthy that the local populace continues to depend on various wild plant species for their daily requirements. Notably, species such as *Rhododendron barbatum, Myrica esculenta, Grewia optiva, Ficus auriculata*, and *Urtica dioica* face significant anthropogenic pressures, raising concerns about their potential gradual disappearance from their natural habitats. This observation underscores the importance of fostering community engagement through awareness campaigns. These campaigns should emphasize the inherent value of plant species in supporting human life, advocate for their sustainable utilization, and stress the need for active participation in biodiversity preservation efforts within the local context.

Conclusion

In rural India, wild edible plants are essential for food security and dietary variety. The many plant species found in the Garhwal Himalaya region are essential to the indigenous population, particularly in times of food scarcity. A more varied food culture that reconnects us with our culinary roots and encourages ecological care may result from the rediscovery of these plants. This essay examines Tehri's Jaunpur block. There is an opportunity for value-added entrepreneurship in berberis and rubus fruits, although leaves make up 25%. In order to promote the value of plant species in sustaining human life, sustainable usage, and biodiversity preservation, the study highlights the significance of community participation and awareness initiatives. The research revealed a diverse array of 68 wild edible plant species, encompassing 59 genera and 38 families. This comprehensive study has illuminated the specific wild edible plant preferences within the local community. The findings underscore the crucial role played by wild edible plants in bolstering the livelihoods and food security of local communities. They emphasize the imperative need for sustainable practices and conservation efforts to safeguard these invaluable resources for future generations.

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Authors Contribution

Professor S. P. Joshi played a crucial role in supervising and providing conceptual advice for this research. He offered valuable suggestions during the preparation of the manuscript, ensuring that the work was thorough and well-informed. Manisha Pandey significantly contributed to the research by conducting fieldwork, meticulously analysing the data, and preparing the manuscript. Additionally, Sachin Sharma made substantial contributions by assisting with data analysis and manuscript preparation, ensuring that the research was comprehensively documented.

Conflict of Interest

The authors declare that they have no known financial or personal conflicts that could have influenced the research presented in this study. The authors also assert that they do not have any conflicts of interest.

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