

Wild edible plants sustaining food security among indigenous communities in Kashmir Himalayas, India

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Gujjar and Bakarwal communities of Kashmir Himalayas living in remote and mountainous regions possess limited resources to sustain their life. The local wild edibles are still utilized traditionally by these tribal communities, but this traditional knowledge is yet to be documented. Therefore, the present research was conducted to explore and prospect the wild edible plants traditionally consumed by the tribal communities in India. Field appraisals included preparation of semi-structured interview schedules, interview of primary respondents, participatory observation and open listing. A total number of 111 respondents were selected by employing the multistage random sampling approach and information regarding Wild Edible Plants (WEPs) was collected. The Relative Frequency of Citation (RFC) was evaluated to recognize the most culturally important WEPs among indigenous communities. A total of 55 plant species of WEPs extracted by the indigenous people corresponding to 45 genera and 31 families were documented. Among all the species, *Malva neglecta* demonstrated the highest RFC value (0.87) whereas *Taxus contorta* with the least RFC value of 0.03. The WEPs used by the Gujjar and Bakarwal tribes are diverse and prolific in the Himalayan region. The present study could be a keystone to be reformulated in other regions of India as well as to be wide spreading through nutrigenomics and pharmacological explorations in order to sustain traditional native knowledge.

Keywords: Edibles, Indigenous communities, Traditional knowledge, Wild plants

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Wild plant species are the important source of nutritional diet, healthcare, material subsistence in many of the developing countries for instance India and share an intricate relationship with the human livelihood. India is one of the mega biodiversity hotspots in the world and possesses a diverse range of WEPs (wild edible plants) with a wide distribution and copious reserves. WEPs represent those species that are not domesticated or cultivated but derived from the natural environment and are utilized as food sources¹. WEPs are normally collected from various habitats, such as, forest, farmland, and also from sites which are anthropogenically disturbed *viz.*, roadsides, river banks and wastelands through diverse traditions across the country. A wide variety of wild food plants and their different parts for instance, fruits, green leafy shoots, flowers, nuts, seeds and below ground parts are still being used regularly. In India, there are a total number of 1,532 wild edible plants and out of

which, *Malva neglecta*, *Portulaca oleracea*, *Scheichera oleosa*, *Sonchus oleraceus* and *Ziziphus mauritiana* are some of the commonly consumed species in different states of the country²⁻⁴. The utilization of these wild edible plants which predates agricultural sector is an ancient phenomenon⁵. They have been essential dietary components for most communities, and the species and mode of consumption have evolved in response to local perspectives, priorities, and cultures. A large number of local population and ethnic groups obtain a significant part of their livelihood and subsistence from these wild plants⁶. Furthermore, wild edible plants enhance the nutritional quality of rural diets as proteins, essential minerals, micronutrients (vitamins) which are at times superior to those of cultivated varieties⁷. Thus, they offer an inexpensive food sources for semi-urban and rural communities throughout diverse regions and cultures, especially in periods of seasonal food short age⁸. Food insecurity and malnutrition affect much of the human

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population. Therefore, there is requirement of a wide spectrum of nutritional food plants to maintain a safe and resilient dietary supply while adapting to the global climate change and unrelenting human population expansion. Despite of green revolution in India, the increased rates of poverty and the elevated economic growth has botched to improve food security problems among rural communities⁹. In addition, the rise of industrial agriculture, fast urban sprawl, as well as the declining forest and semi-natural forest areas have greatly influenced the chain of food system¹⁰. However, the role of WEPs cannot be underestimated as they are the main sources of food and deliver staple food, vegetables, spices, and fruits for the indigenous people. These food plants play a vital part in the growth and development of new crops through cultivation, led to domesticated food plants and intensifying local food security⁹. WEPs are a low-input, low-cost alternative for rising nutrition and reducing the need to pay out limited money resources¹¹. During the periods of scarcity and famine, wild plant resources for nutrients as well as the health promoting compounds have received keen consideration in peri-urban and rural regions¹². Several ethnopharmacological investigations also demonstrated that the native individuals who collected diverse wild plants for nutritional food possess indigenous knowledge concerning the health benefits of those species¹³. There have been attempts to prospect WEP extraction and consumption traditions in India since long time; though because of the great diversity of both the flora and ethnic inhabitants of the country, the research is still in its early stage^{14,15}. Likewise, UT Jammu and Kashmir is endowed with an affluent diversity of wild edibles where the native tribal communities are well acquainted with these wild food plants and obtain majority of their livelihood from them¹⁶. The traditional knowledge gained by these people is transmitted from generation to generation by means of oral conversation. But in various regions, it is found that this ancient traditional knowledge is disappearing due to the advanced developmental activities as well as modernization¹⁷. Therefore, the research work portrayed in this paper intends to document the collective knowledge of wild food plants extracted by the Gujjar and Bakarwal communities, coupled with the utilization pattern and cultural significance of these species. Earlier ethnobotanical investigations in Ganderbal District of Kashmir Himalayas have

completely focused on economically valuable species¹⁸ or on the ethnomedicinal values¹⁹, so a clear knowledge gap appears for the inventory and cultural significance with regard to wild edibles.

Materials and Methods

Description of study area

The present study was investigated in the District Ganderbal, located in Kashmir Himalayas of Union Territory of Jammu and Kashmir. It covers a total area of 1979 km² of land and lies between 34.23° N Longitude and 74.78° E Latitude (Fig. 1). It mostly stretches with a length of 125 kms from Southwest to Northeast with a width of around 10-20 kms at an altitudinal range of 1650 to 3000 m above the Mean Sea Level (MSL). The climate of area is temperate showing temperate as well as sub-alpine situations throughout various seasons of year. Nearly 70% area of the district is mountainous and semi-mountainous covered with forest vegetation. The vegetation growth from west to east direction alongside the River Sindh changes from temperate to alpine as the elevation increases. The region is highly populated in contrast with other mountainous areas of the Himalayas, primarily by rural population who settled down in the villages proximate to the forest are as²⁰. Moreover, some regions remain inaccessible for quite some time during winter.

Field research and data collection

Before the ethnobotanical survey, a preliminary comprehension was apprehended with the help of

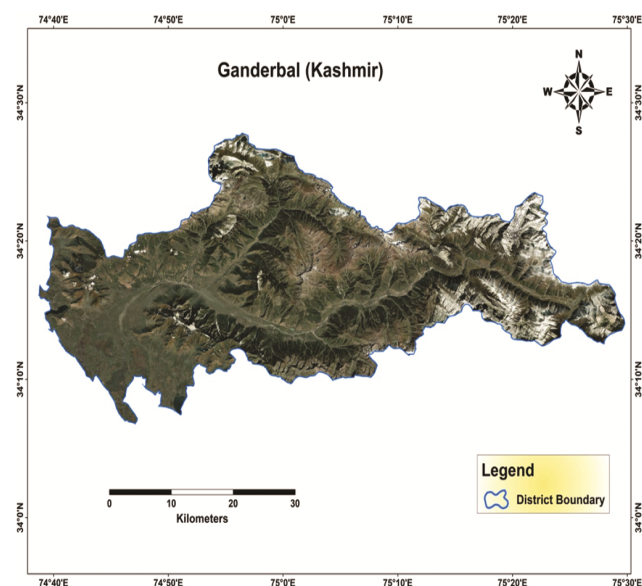


Fig. 1 — Map of study area (Source: Google Earth)

local maps, chronicles and flora, which included climate, topography and vegetation of the study area, in addition, religious beliefs, history, rituals as well as socio-cultural values of the rural people, which assisted to choose suitable locations and times for the investigation. A good systematic and extensive ethnobotanical appraisal was conducted in selected villages of the district from August 2019 to April 2021 for the information collection on wild food plants being utilized by indigenous groups in the study location. A total of one hundred eleven (111) informants were selected using the multi stage random sampling method²¹ and the field surveys comprised key informant interviews through well-structured pre-tested interview schedule, open listing and participatory observation. Prior informed content was obtained from all the informants. However, the semi-structured questionnaire was directed to the informants in native language and the answers were documented in English. It was planned to emphasis on the vernacular names of edible plants, habit, plant parts utilized, availability, method of utilization/consumption, taste, frequency of use, seasons of collection, if it is consumed as medical food, and other miscellaneous uses. For the identification purpose, the voucher specimens of plants were gathered from the study location and then got identified from the taxonomist expert of Sher e Kashmir University of Agricultural Sciences and Technology of Kashmir and also with the aid of various local floras²². Furthermore, the botanical nomenclature of species and the International Plant Names Index (<http://www.ipni.org>) were also followed for the preparation of final list of the plant species.

Demographic characteristics of the study area

Agriculture is the major land use in the selected villages having net sown area ranging from 13.8 ha to 232.7 ha. The number of households ranged from 50 to 932 in these selected villages which shelter populations ranging from 375 to 6616 individuals. Most of the individuals belong to Scheduled Tribes, whereas, the Other Backward Class and Scheduled Castes were lowest in number. Though, the household survey demonstrated the majority of informants were middle aged heads (45.04%), having low education (31.53%) and the herd size among the maximum (64.86%) household heads ranged up to 5 animals. The majority of the informants (71.17%) were showing an approximately <2.5 km proximity to the

forests where the maximum surveyed household heads visited forests frequently among the sample population.

Data analysis

In order to check the validity of data concerning the native importance of plant species concerning the respondents who declared its utilization in the study location, Relative Frequency of Citation (RFC) was evaluated.

Relative frequency of citation (RFC)

It is a mathematical expression of the percentage of frequency of reporting a certain species by respondents²³ and is determined by employing the formula:

$$RFC = \frac{FC}{N}$$

Where N is the total number of respondents and FC is the number of respondents mentioning the use of a particular plant species. The range of RFC varies between 0 and 1 and greater the RFC value, the more valuable and significant the plant is in the region. The significance of each food plant species was evaluated by FC value, which validated all wild edible plants documented in significant survey to be mentioned in the queue of importance.

Results

Diversity and habit of wild edibles

The current study reported a total of 55 wild edible plant species belonging to 45 genera under 31 families based on the ethnobotanical as well as the botanical information involving scientific names, vernacular/common names, families, plant habit, mode of consumption, plant part used, time of availability, specimen numbers, and RFC are listed in Table 1. The plant habits of the documented wild edibles used by the tribes comprise trees, shrubs, herbs, fern and fungi (Fig. 2). Majority of the reported species belongs to herbs, with 37 species corresponding to 22 families. Asteraceae and polygonaceae were reported as the major families with 6 species each, followed by Malvaceae with 3 species (Fig. 3). Shrub was found as the second largest group comprising 9 species presenting 5 families, whereas, trees with five species (3 families), fungi containing three species (3 families) and ferns with only one species (one family).

Table 1 — Diversity, plant habit, mode of consumption and citation index of wild food plants

Family	Specimen number	Species / Scientific name	Vernacular name/ common name	Plant habit	Plant parts used	Mode of consumption	Time of availability	Relative Frequency of Citation (RFC)
Taxaceae	004035	<i>Taxus contorta</i> Griff.	Poshtul / Himalayan yew	T*	Fruits	Fruits are eaten as raw.	Autumn	0.03
Onagraceae	004051	<i>Oenothera rosea</i> L.' Her. Ex Aiton	-/ Rose evening primrose	H*	Leaves	Leaves boiled to make tea and drank to treat obesity.	Late spring- mid summer	0.08
Berberidaceae	004030	<i>Berberis lyceum</i> Royle	Kawdach / Barberry	S*	Fruits	Fruits edible.	Spring	0.09
Asteraceae	004042	<i>Anthemis cotula</i> L.	Fakhgasseh/ Stinking chamomile	H	Whole plant	The herb is used as flavoring agent.	Spring	0.10
Rosaceae	004055	<i>Rosa webbiana</i> Wallich ex. Royle	Bottegulab/ Webb's rose	S	Fruits	Ripe fruits are edible.	Summer	0.14
Rosaceae	004029	<i>Rubus fruticosus</i> Thunb.	Chaanch / Hill raspberry	S	Fruits	Fruits are edible.	Autumn	0.14
Berberidaceae	004062	<i>Berberis aristata</i> DC.	Danelider, Indian barberry	S	Fruits	Fruits are edible.	Spring	0.15
Rhamnaceae	004065	<i>Ziziphus jujuba</i> Mill. subsp. <i>Spinosa</i>	Brai/ Chinese red date	S	Seeds, Fruits	Dried fruits are edible and seed decoction given to recover from jaundice.	Autumn	0.15
Elaeagnaceae	004059	<i>Elaeagnus parvifolia</i>	Autumn olive	S	Fruits	Fruits are edible.	Autumn	0.17
Moraceae	004050	<i>Ficus carica</i> L.	Aunjoor/ Common fig	T	Fruits	Ripe fruits are eaten.	Summer	0.18
Juglandaceae	004027	<i>Juglans nigra</i> Linnaeus	Doon/ Eastern black walnut	T	Nuts	Nuts are edible & nuts along with hard shell are crushed and boiled to extract edible oil.	Autumn	0.18
Rosaceae	004036	<i>Rubus ulmifolius</i> Schott	Chaanch / Thornless blackberry	S	Fruits	Fruits are edible.	Summer	0.20
Moraceae	004043	<i>Morus alba</i> var. <i>serrate</i>	Tul/ Himalayan mulberry	T	Fruits	Fruits are edible.	Late spring	0.21
Rosaceae	004052	<i>Rosa moschata</i>	Kreer/ musk rose	S	Fruits	Fruits are edible.	Mid summer	0.24
Asteraceae	004028	<i>Centurea iberica</i> Trevir. & Spreng.	Krach / Iberian star- thistle	H	Roots	Roots are cooked and then eaten as vegetable.	Late summer	0.27
Caprifoliaceae	004016	<i>Viburnum grandiflorum</i> Wallich	Kulmachh/ Grand viburnum	S	Fruits	Fresh fruits are edible.	Summer	0.27
Podophyllaceae	004061	<i>Podophyllum hexandrum</i> Royle	Van vangun, Bankakri/ May apple	H	Fruits	Ripe fruits are edible and its juice is taken against dyspepsia and stomach ulcers.	Summer	0.27
Amaryllidaceae	004046	<i>Allium semenovii</i> Waldst. & Kit.	Janglipran/ Wild onion	H	Bulb	Bulbs are used as flavouring agent.	Late spring	0.33

... Contd.

Table 1 — Diversity, plant habit, mode of consumption and citation index of wild food plants (Contd.)

Family	Specimen number	Species / Scientific name	Vernacular name/ common name	Plant habit	Plant parts used	Mode of consumption	Time of availability	Relative Frequency of Citation (RFC)
Asteraceae	004037	<i>Saussurea costus</i> (Falc.) Lipsch.	Kuth / Costus	H	Leaves	Fresh or dried leaves are used as vegetable.	Mid summer	0.33
Morchellaceae	004017	<i>Morchella esculenta</i> Fr.	Kanighitch/ Yellow morel	F*	Basidiocarp	Basidiocarp- used as vegetable.	Spring	0.33
Rosaceae	004049	<i>Potentilla reptans</i> L.	Taqtishtaber / Creeping cinquefoil	H	Roots	Dried roots are used to make tea.	Summer	0.33
Onagraceae	004026	<i>Epilobium hirsutum</i> L.	-/ Willow herb	H	Leaves	Edible leaves and are used to make tea.	Spring	0.35
Asteraceae	004053	<i>Cirsium arvense</i> (L.) Scop.	Kandehgoogeh/ Creeping thistle	H	Fruits, Leaves	Leaves and fruits are edible.	Late spring	0.36
Athyriaceae	004056	<i>Diplazium sibiricum</i>	Kunjee/ Mole-ladder	Fr*	Fronds	Vegetable	Mid summer	0.42
Hypericaceae	004013	<i>Hypericum perforatum</i> L.	Chai kul/ John's wort	H	Whole plant	Whole plant powder is taken with water or milk to make tea and also to treat rheumatism.	Mid summer	0.47
Juglandaceae	004031	<i>Juglans regia</i> L.	Doon / Himalayan walnut	T	Nuts	Nuts are edible.	Autumn	0.51
Polygonaceae	004018	<i>Polygonum hydropiper</i> L.	Maachran chai / Water pepper	H	Roots	Dried roots are boiled in water. A little salt and milk is added to prepare tea.	Summer	0.51
Brassicaceae	004060	<i>Capsella bursa pastoris</i> L. Medik	Kralemundh/ Shepherd's purse	H	Entire plant / Leaves	Entire plant / leaves- used as vegetable.	Mid summer	0.54
Boraginaceae	004012	<i>Arnebia benthamii</i> (Wallich ex. G. Don) I. M. Johnston	Kahzaban / Beared borage	H	Shoot	Dry flowering shoot is cooked and eaten.	Late summer	0.56
Oxalidaceae	004038	<i>Oxalis corniculata</i>	Tsok-tsen/ Creeping wood sorrel	H	Leaves	Vegetable.	Spring	0.56
Polygonaceae	004033	<i>Rheum emodi</i> Wall. Ex Meisn.	Pambhakh/ Himalayan rhubarb	H	Leaves	Dried leaves used as vegetable.	Late summer	0.58
Apiaceae	004057	<i>Daucus carota</i> L.	Gazregasseh/ Wild carrot	H	Roots	Roots are edible.	Mid summer	0.60
Agaricaceae	004066	<i>Agaricus campestris</i> L.	Headur / Field mushroom	F	Basidiocarp	Basidiocarps are cooked.	Spring	0.63
Dipsacaceae	004019	<i>Dipsacus inermis</i> Wallich	Vopalhakh/ Teasel	H	Shoot, Leaves	Leaves / stem – used as vegetable.	Summer	0.63
Fabaceae	004047	<i>Glycyrrhizae glabra</i>	Shangir/ Liquorice	H	Roots	Roots are used to make tea and also administered orally as expectorant.	Autumn	0.63
Asteraceae	004063	<i>Cichorium intybus</i> L.	Kaw handh/ Common chicory	H	Leaves	Leaves – used as vegetable	Spring	0.65

... Contd.

Table 1 — Diversity, plant habit, mode of consumption and citation index of wild food plants (Contd.)

Family	Specimen number	Species / Scientific name	Vernacular name/ common name	Plant habit	Plant parts used	Mode of consumption	Time of availability	Relative Frequency of Citation (RFC)
Malvaceae	004025	<i>Lavatera cashmeriana</i> L.	Sazposh / Tree mallow	H	Flowers, Seeds	Flowers and seeds are edible.	Spring	0.65
Polygonaceae	004039	<i>Rumex scutatus</i> L.	Kadhi / French	H	Leaves	Leaves used as salad.	Mid summer	0.65
Ranunculaceae	004020	<i>Ranunculus acris</i> L.	Sorrel Batakloth / Meadow buttercup	H	Leaves	Leaves are edible.	Spring	0.69
Solanaceae	004064	<i>Solanum nigrum</i> L.	Kambai / European black nightshade	H	Fruit	Fruits are eaten and used as laxative and tonic.	Autumn	0.69
Fabaceae	004024	<i>Medicago sativa</i> L.	Lasunghas/ Lucerne	H	Sprouts	Sprouts are edible.	Spring	0.71
Polygonaceae	004032	<i>Oxyria digyna</i> (L.) Hill	Chokhakh / Mountain sorrel	H	Leaves	Leaves used as vegetable.	Late summer	0.71
Rosaceae	004058	<i>Fragaria nubicola</i> L.	Jungliishtaber / Wild strawberry	H	Fruits	Fruits are edible.	Autumn	0.71
Amaranthaceae	004011	<i>Amaranthus caudatus</i> L.	Lisse, Ganhaar / Pendant amaranth	H	Leaves, Seeds	Seeds and leaves are edible.	Spring	0.72
Apiaceae	004040	<i>Foeniculum vulgare</i>	Janglibedyaan/ fennel seeds	H	Seeds	Seeds-used as spices and mouth freshener.	Autumn	0.75
Asteraceae	004045	<i>Taraxicum officinale</i> Webr	Handh/ Common dandelion	H	Roots, Leaves	Roots and leaves used as vegetable.	Spring	0.75
Malvaceae	004021	<i>Malva sylvestris</i> (L.) Boiss	Dom sochal / Mallow	H	Flowers	Flowers used as vegetable.	Spring	0.76
Pleurotaceae	004014	<i>Pleurotus</i> spp.	Heindh / Tree mushroom	F	Basidiocarp	Basidiocarp-used as vegetable.	Autumn	0.77
Plantaginaceae	004022	<i>Plantago lanceolata</i> Linn.	Nick gul/ Ribwort plantain	H	Leaves	Vegetable	Late spring	0.78
Plantaginaceae	004048	<i>Plantago major</i> L.	Bod gul / Broad leaf plantain	H	Leaves	Leaves are edible as salad.	Mid summer	0.83
Lamiaceae	004041	<i>Mentha arvensis</i> L.	Pudneh / Wild mint	H	Leaves	Fresh leaves are chewed as mouth freshener and used to make chutney.	Spring	0.83
Polygonaceae	004034	<i>Rumex acetosa</i> Linn	Abij / Sheep's sorrel	H	Leaves	Leaves-vegetable	Spring	0.83
Portulacaceae	004054	<i>Portulaca oleracea</i> L.	Nunnar / Purslane	H	Leaves	Leaves used as vegetable.	Spring	0.83
Polygonaceae	004023	<i>Rumex hastatulus</i> Baldw.	Jungliabij / Heartwing sorrel	H	Leaves	Leaves used as vegetable.	Late spring	0.85
Malvaceae	004015	<i>Malva neglecta</i> Wallr.	Sochal / Cheese cake flower	H	Leaves	Leaves are useful in piles and also used as vegetable.	Spring	0.87

*T= Tree, S= shrub, H= Herb, Fr= Fern, F= Fungi

All of the documented WEPs were taken either as fresh eatables or immediately after their collection, most of them were stored in dried form, which are

therefore of utmost importance in the times of emergency particularly during winters. Leaves were mostly consumed in cooked form as vegetable, while

nuts, fruits in addition to certain seeds were exclusively eaten in both the raw and uncooked forms (Table 1), for example, nuts of *Juglans* species and fruits of *Morus* species could be eaten raw.

Citation values

The values of RFC (Relative Frequency of Citation) were employed to evaluate the local significance of wild edible plant species in the study area are demonstrated in the Table 1. The estimated RFC values ranged from 0.03 to 0.87. Among all the species, *Malva neglecta* revealed the highest RFC value (0.87) whereas *Taxus contorta* showed the least RFC value of 0.03.

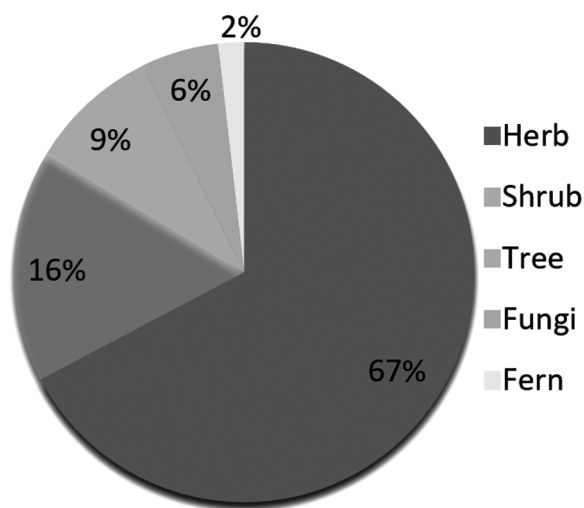


Fig. 2 — Plant habit of WEPs

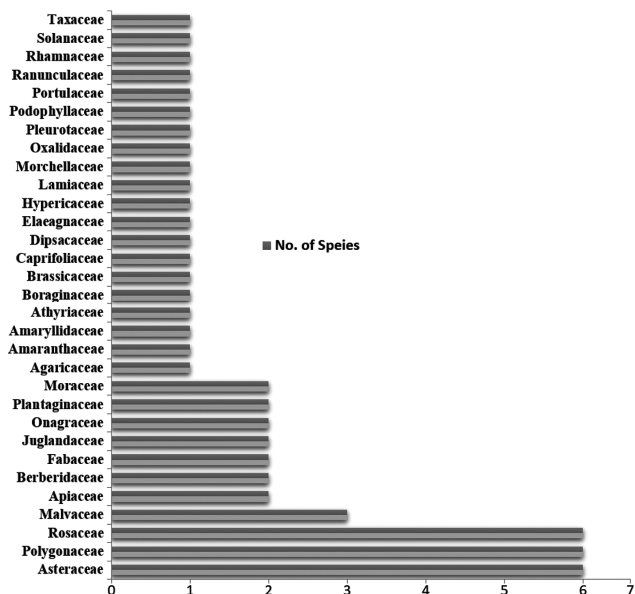


Fig. 3 — WEPs represented by different families

Edible parts, food categories and time of availability

Various plant parts are edible, for instance leaves, flowers, whole plant, basidiocarp, seeds, fruits, roots, sprouts, shoots, tubers, fronds and bulbs, among which the mostly utilized plant parts are leaves, followed by fruits and then roots (Fig. 4). The wild vegetables include *Portulaca oleracea*, *Dipsacus inermis*, *Rumex hastatulus*, etc. and wild fruits like *Viburnum grandiflorum*, *Fragaria nubicola*, *Ziziphus jujuba*, etc. are the two main categories of Wild food plants (Fig. 5).

WEPs used by the Gujjar and Bakarwal tribes could be extracted all throughout the year. However, the time and season of availability of wild edibles rely on the maturation stage of the plant parts used; nevertheless, majority of them are available and collected from the Spring season to Autumn season (Fig. 6). Only a small quantity of wild edibles can be collected during the winter when the study location is fully shielded with snow cover. The time of availability of wild vegetables and its collection is mainly done from Spring to Summer (March to July), and the time season of availability of various wild fruits is from Summer season to Autumn (July to September).

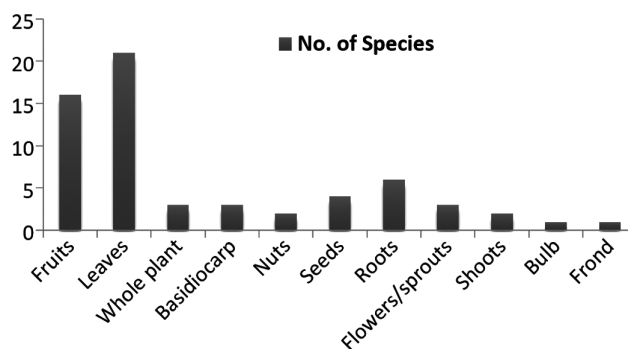


Fig. 4 — Plant parts used by indigenous communities

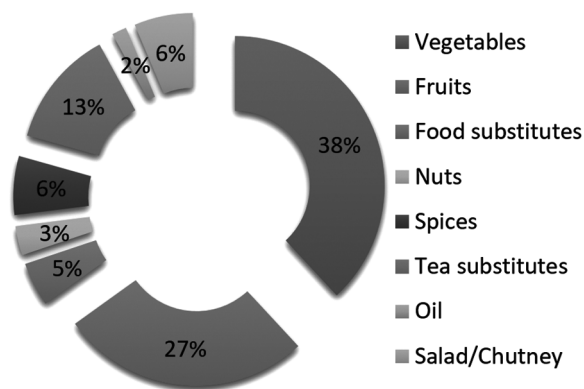


Fig. 5 — Food categories of wild edible plant species

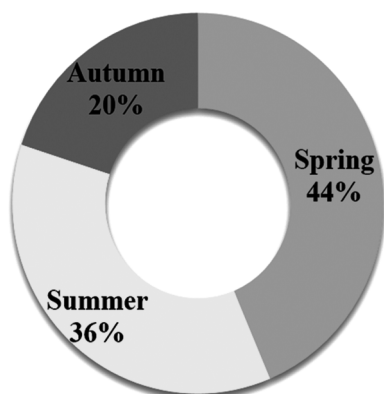


Fig. 6 — Time of availability of wild edible plants

Discussion

Depiction of the ethnobotanical data and indigenous traditional knowledge

The documented wild edible plants in the study location appeared in a wide range of diversity with a maximum number of species (55), genera (45) as well as families (31). This wide spectrum of WEPs supports an extensive and numerous alternative options of nutritional diet, thereby ensuring the food security in the region. Several studies exhibited the diverse range of wild edible plants used by various indigenous groups are in conformity with the current study results²⁴⁻²⁶. The first three families of flora of the Temperate Forests of Kashmir Himalayas (Asteraceae, Lamiaceae, and Ranunculaceae) do not match exactly in the same sequence with the most documented families in the survey (Asteraceae, Polygonaceae, and Rosaceae). Similar investigation in the Kupwara District showed that the families Rosaceae, Polygonaceae, and Asteraceae were the dominant in wild edible plants²⁷. Undoubtedly, the two studies are also cited in two districts of Kupwara and Ganderbal, representing distinct climatic conditions could well elucidate the variations in the plant availability and thus their frequency of utilization. The wild vegetables as well as fruits are the primary food categories used by various indigenous people are in accordance with other studies^{18,28}. Clearly, it is indicated that the richness and availability of wild plant species in the surrounding environment of the people is associated to the extent level of utilization though it is not the sole cause²⁹. We also noticed in the present study location that there is a resilient relationship between the environment and local people, and therefore, they have a good indigenous knowledge that transmits

among native groups. However, they could inevitably be able to search out wild edibles and ignore wild inedible or toxic plants. They can even distinguish between the species belongs to one category to identify if it is edible or toxic.

The preponderance of wild edible plants in the present study were consumed for their green leaves, fruits followed by roots, which are in agreement with the findings of several authors^{26,27}. Several species like *Plantago lanceolata*, *Malva sylvestris*, *Taraxicum officinale* and *Portulaca oleracea* were utilized only for their green leaves. *Mentha arvensis*, locally known as "Pudneh", was the most documented species (Table 1), very highly valued and liked for its fragrance and is well recognized for its medicinal properties¹⁹. This particular species was used in various Kashmiri recipes. The green leaves and tender stems were utilized as salads, pickles and to add flavor as well as garnish meat and chicken dishes. The ethnobotanical research carried out in Kashmir Himalayas by Mir *et al.*³⁰ demonstrated *Mentha arvensis* was the most frequently used plant species. However, in Haq's study³¹ in the Western Himalayan region, it was cited frequently for food purposes and this may show its interest. In general, several studies carried out on wild food plants in our country India demonstrated that various plant species, for instance *Portulaca oleracea*, *Plantago major*, *Taraxacum* sp. and *Malva neglecta* were commonly extracted and consumed, though the variation was found in recipes^{3,32,33}.

Influences of age, gender, education, main occupation and vicinity to forests on indigenous knowledge of wild edible plants

Anthropogenic factors are vital for the inheritance of indigenous traditional knowledge regarding the wild edible plants. Several factors like age, education level, gender, and occupation of the household heads are generally contemplated in the research study. In the present study, there exists a positive significant correlation between education level of respondents and the level of knowledge of forest derived edible plants owned by indigenous groups with the main occupation. But, there is no significant correlation between age, those numbers and the gender of the informants. Out of the total (111) informants, men and women demonstrated 54.95% (61) and 45.04% (50) respectively. Earlier investigations have revealed that the gender is a significant factor that impacts the dissemination of native traditional knowledge; in addition, women possess more good traditional knowledge since they are generally jobless, and

thereby dedicating themselves to subsistence works and household chores in rural areas²⁶. Additionally, there exists no significant correlation between the female and male groups in the temperate forest Himalayas. This finding is in conformity with the several previous studies³⁴⁻³⁶. Owing to the harsh topographical and weather conditions in the study area, females are greatly responsible for collecting nearby grown plants for cooking purposes and generally not able to take part in field meetings, whereas, men frequently collected wild plant species. Perhaps this is for the reason that illiterate people rely greatly on agricultural practices, whereas the educated people normally opt other jobs rather than the agricultural jobs. One of the most important factors is that the native communities usually resided in inaccessible and remote areas with insufficient infrastructure and transportation; thus farmers have been engaged in farming practices and became well acquainted with native WEPs. This enabled local farmers/growers to preserve much traditional knowledge regarding WEPs than the people involved in other jobs in the study region.

Conclusion

The current study demonstrated wide spectrum of wild plants was used as diet by Gujjar and Bakarwal tribal people of Kashmir Himalayas in order to sustain basic requirements of their life. Commonly used plant parts were leaves, fruits, and roots and the wild edibles supply food with nutritional values for keeping people healthy. But the indigenous traditional knowledge on the utilization of wild food plants is getting diminished because of the advanced modernization. Therefore, it is compulsory to document the important wild edible plants and their associated knowledge by taking the effective measures to preserve and conserve all those species with high Relative Frequency of Citation (RFC), otherwise a significant number of essential eatables will get extinct in wild. In recent times, majority of the native people in the research area still utilize WEPs as nutritional security especially during winters and also as native traditional culture. In the future, WEPs with economic potential could be established to generate a source of revenue for the tribal people. The present study supports the significance of the indigenous knowledge of the WEPs in the Himalayas to preserve it from the crisis of famine, conflicts and economic crises that threaten the human race as well

as local traditional knowledge. Hence, this research can also be a keystone to be reformulated in other regions of India and to be expanded through pharmacological and nutrigenomics explorations to sustain this indigenous traditional knowledge.

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Ethics Approval and Consent to Participate

Prior oral informed consent was derived from the native communities as well as from all individual participants.

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author Contributions

S K: Investigation, Writing original draft preparation and Editing, TH M: Supervision, Conceptualization, Data curation and Validation, MA I: Software, Methodology, JA M: Visualization, NA P: Supervision, Writing- Reviewing and Editing, A R: Data curation, Editing, U A: Reviewing, S Z R: Editing.

Data Availability

The author confirms that all data generated or analyzed during this study are included in this published article.

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