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Wild edible plants of latti-dudu valley of district Udhampur (Jammu and Kashmir): A part of North West Himalayas, Jammu and Kashmir, India

Jawaid Sarver[1], Amrita Nigam[2]
[1]Department of Botany, Govt. Degree College Udhampur, Jammu and Kashmir, India
[2]School of Sciences (SOS), Indira Gandhi National Open University, Main Campus, Maidan Garhi, New Delhi, India

Abstract
The present study was carried out in Latti Dudu valley and its surrounding areas of District Udhampur of J&K to obtain information about wild edible plants used by the local nomads, semi nomads, migratory shepherds and tribes like Gujjars, Bakerwals, Gaddi & Sippi etc. Questionnaire for the survey, personal field visits and participatory observations were used to collect information about the use of various plants. Total 47 wild edible plants belonging to 28 families and 39 genera were collected and identified from the area. Rosaceae was the dominant family represented by 6 taxa, followed by the Polygonaceae with 5 taxa, while Moraceae and Leguminosae represented 3 taxa each. Amaranthaceae, Asteraceae, Urticaceae, Lamiaceae, Plantaginaceae and Violaceae represented by 2 taxa each and rest 18 families were represented by one species each. The growth form analysis of Wild Edible Plants revealed that herbs made the highest proportion of the wild edible species 27 (57.4%) followed by shrubs 9 species (19.1%), trees 7 species (14.89%), climbers 1 species (2.12%), fungi 2 species (4.25%) and fern 1 species (2.12%). The plant species were consumed as raw as well as in cooked form, 13 species were used in raw form while 34 species were taken in cooked form. The plant species like *Viola odorata*, *Morchella esculenta*, *Diplazium esculentum*, *Polygonum amplexicaulis*, *Punica granatum*, *Juglens regia*, *Diopyros lotus and Mentha sps*. etc are also sold in the local market as a supplementary source of income. Mass scale cultivation of such wild edibles in the area may reduce the human pressure on the wild habitats. Therefore, proper conservation measures should be taken to maintain the current status of these habitats and plant species.

Keywords: wild edible plants, nomads and semi-nomads, tribes, conservation

Introduction
Wild plants played a very important role in human life since ancient times. They have been used for food, medicine, fibers and other purposes and also as fodder for domestic animals. In search for wild food plants many of which are potentially valuable for human beings have been identified to maintain a balance between population growth and agricultural productivity, particularly in the developing countries [1]. A huge number of ethnic communities and local populace residing in the developing countries draw a significant part of their subsistence and livelihood from wild plants [2].

At global level in many developing countries, large number of populations don't have sufficient food for their daily needs and many people are lacking one or more micronutrients [3]. Our country with 2nd largest human population on the earth [4] can also use these wild resources to supplement their food and nutritional needs.

In India most rural communities depend on the wild resources including wild edible plants to meet their food needs in a period of food crises as well as for additional food supplements [5-6]. There are about 1532 edibles wild food species available in India out of these 675 species are found in Himalayan region [7-8].

As far as Indian Himalayan Region (IHR) is concerned, it covers approximately 5,91,000 km2 which is only 11% of the country's geographical area and is one of the 12 mega-diversity countries of the world and it accounts for more than 50% of the country's forest cover with 40% of the endemic species [9-10]. The diverse natural habitat all over the IHR represents rich repositories of plant diversity [11]. The inhabitant utilizes this rich biodiversity in various forms as fodder, fuel wood, wild edibles, medicine, house buildings, religious and other purposes [12].

The Union territory J&K is a North West part of IHR which is also endowed with rich biodiversity which is unique and representative of the area. Various studies have been carried out on ethnobotanical and ethnomedicinal uses of floristic diversity in J&K [13- 19] but only few references are available regarding usage of Wild Edible Plants [20-26].

From Udhampur District of J&K only single report of 90 wild edible plants was made by Bhattia *et al*.[27]. Latti-Dudu valley of District Udhampur is one of the remotest and hilly mountainous terrain of the Himalayan region, which is remain ethno botanically unexplored. The main occupation of the inhabitants is agriculture and livestock. However, due to the possession of small land holdings and since agriculture is mostly rain fed; food grain production is far from satisfactory. Average Economic condition is generally poor, so it is very difficult for them to meet their daily needs for survival. Hence, they are totally depend upon the forest resources. Gujjars, Bakerwals and Gaddis constitute the major population of the area. They lead the nomadic life who grazes their herds of sheep, goats and cattle from the foot hills of study area in the south to alpine pastures of Seojdhar in north using mainly forest resources to fulfill their needs like food, fodder, forage, shelter, fuel wood, fiber and medicine etc. The inhabitants other than these three tribes are also live semi-nomadic way of life. They have also a temporary household in the vicinity of forest in

the higher reaches locally known as Dok/Dhar/dowaar where they spend the whole summer season from April to September. The inhabitants and tribes living in this region depend considerably on the wild edible products of forests and they have acquired considerable knowledge in this field of potential interest.

A scientific study of wild edible plants is important for pin pointing the potential source which could be utilized at the time of scarcity or during normal days or cultivated as a source of food materials for an ever-increasing population. Keeping this in view the present study was conducted as the first ever attempt from the region to explore and identified the wild edible plants resources, to record the indigenous traditional knowledge of utilization of wild plants resource consumed by the inhabitants of the area.

Methodology

Study Area

Latti-Dudu valley is situated at a distance of 85 km in the Northeast direction of district headquarter Udhampur. The study area is fall in Udhampur and Ramnagar Forest Divisions with an altitude that varies from 1800m to 3200m amsl. The area is mostly hilly and mountainous and weather is moist temperate. The whole valley experiences regular snowfall during the winter months starting from December onward and stay there up to the end of March. About 50% area is remain under snow throughout the winter season. The forests in the area are coniferous, consisting of *Cedrus deodara, Pinus wallichiana, P. roxburgii* and *Abies pindrow*, however some broad leaved associates like *Quercus floribunda, Q.leucotrichophora, Rhododendron arboreum* and *Alnus nitida etc.* are found mixed together at some places.

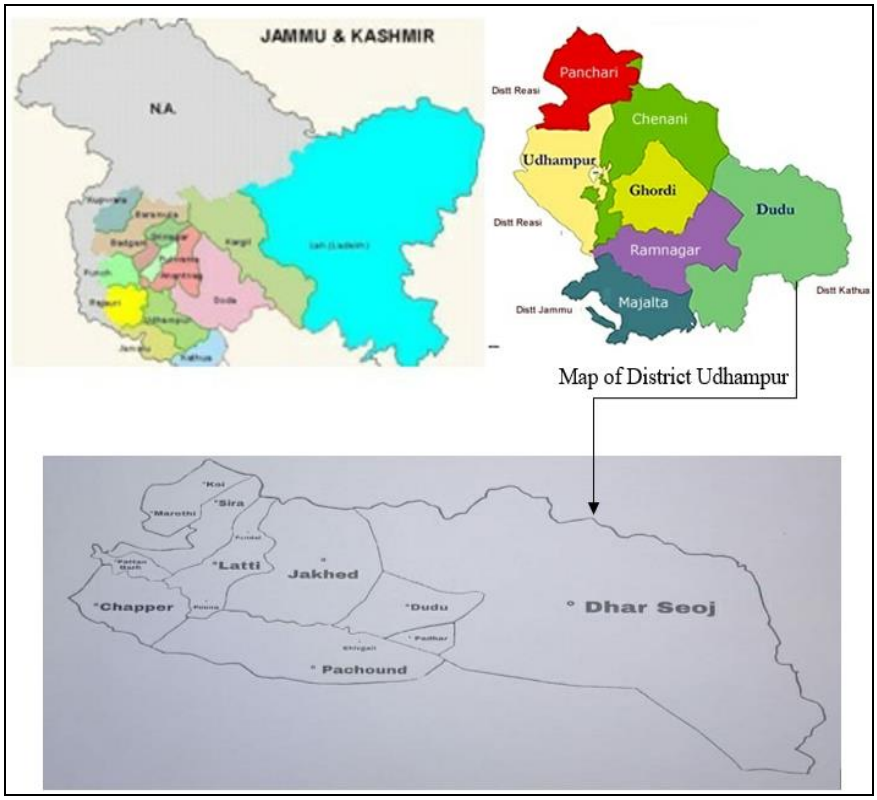

Fig 1: Map of study area (Latti-Dudu Valley)

Ethnobotanical data collection

The data was collected by conducting survey in all season during 2019-2020 and rapid sampling was done. The nomadic, semi-nomadic tribe and inhabitants of 18 representative villages namely Latti, Sira, Koi, Marothi, Pattangarh, Tadbug, Kathal, Jawala, Kound, Pouna, Pundal, Chappar, Diddi beggar, Jakhed, Dudu, Kirchi, Pachound and shivgali were selected to generate information on traditional uses of wild edibles present in the study area. A total of 30 knowledgeable persons were selected randomly as key informants from the 18 representative villages. The selection of key participants was also based on the quality of explanation that particular participants gave during an interview. The standard data collection methods [28-30] have been followed to document indigenous knowledge of the local community on use of wild edibles plants. The techniques employed for data collection were semi structured interviews, group discussion, guided field walks and observation with participants. Semi-structure interviews undertaken were based on checklist of questions prepared in English and translated into local languages like Dogri, Gujjari, and Hindi. The informants included men, women, youth and elders ranged from 20-85 years. Most of them were farmers, herdsmen, shepherds, housewives and they are depend upon agriculture and livestock for their livelihood. The people who were older in age had a rich knowledge base regarding utilization of plants. Information on botanical name, local name, plants part/s used, habit and habitat/s and use values were gathered. Verbal consents were also obtained from the participants about the objectives of the study prior to the interviews and all data were collected through their oral consents.

Frequency index was calculated and recorded in Table 1. Frequency index is a mathematical expression of the percentage of frequency of mentioning for a single botanical

species by informants. The following formula was used to calculate frequency index:

FI = FC/N x 100

Where FC is the number of informants who mentioned the use of the species, and N is a total informants [31] N=30 in this study. The frequency index was high when there were many informants who mentioned a particular plant and low when there were few reports.

Table 1: List of Wild Edible Plants used by the Gujjar, Bakerwals, Gaddis and other Nomadic and semi-nomadic inhabitants of the area.

S.no	Botanical name	Family	Local name	Life forms	Time of availability	Habitat	Parts used and preparations	Frequency Index
1	*Aesculus indica* (Wall.ex Camb.) Hook	Sapindaceae	Goon	T	July- Sep.	1	Seeds are roasted then eaten	6.7
2	*Amaranthus viridis* L.	Amaranthaceae	Chaleri	H	May-Aug.	4,1	Leaves cooked as vegetables	50
3	*Berberis lycium* Royle	Berberidaceae	Kambel	S	June-Aug.	5	Fruits are eaten raw	73.3
4	*Bistorta amplexicaulis* (D.Don) Greene	Polygonaceae	Mashreen	S	June-Sep.	2,5	Dry rhizomes used in tea.	26.7
5	*Cannabis sativa* L.	Cannabinaceae	Pang	S	April-Sep.	1,4,5	Leaves used in smoking, Oil extracted from seeds used in cooking.	6.7
6	*Capsella bursa-pastoris* (L.) Medik.	Brassicaceae	Jadi	H	April-Aug.	1,3,4	Leaves and shoots cooked as vegetables and raw salad.	6.7
7	*Chenopodium album* L.	Amaranthaceae	Jangli palak	H	June-Aug	1,4	Leaves cooked as vegetables	46.7
8	*Cirsium arvensis* (L.) Scop.	Asteraceae	Pouss	H	May-Sep.	2,5	Boiled leaves cooked as vegetables	3.3
9	*Diospyros lotus* Linn	Ebenaceae	Malook	T	Oct.- Nov.	4	Fruits are eaten raw	53.3
10	*Diplazium esculentum*(Retz) SW.	Athyriaceae	Kasroor	Fn	May-Aug.	2,5	Fronds as vegetables and making pickles	73.3
11	*Duchesnae indica* (Jacks.) Focke	Rosaceae	Aankhe	H	June-Aug.	2,5	Fruits are eaten raw	60
12	*Elaeagnus parvifolia* Wall.ex Royle	Elaeagnaceae	Kiyaan	S	July- Sep.	3,5	Fruits are eaten raw	43.3
13	*Fagopyrum dibotrys* (D.Don) Hara.	Polygonaceae	Fafru	H	May-Sep.	2,4	Leaves cooked as vegetables and chapattis	40
14	*Ficus carica* L	Moraceae	Anjeer	T	Aug.-Oct.	1,3	Fruits are cooked as vegetable	10
15	*Ficus palmata* Forssk	Moraceae	Fagwara	T	March-June	3,5	Fruits are cooked as vegetable	16.7
16	*Girardinia heterophylla* (Vahl) Decne.	Urticaceae	Badi saddar	H	June-Nov.	2,3,5	Leaves cooked as vegetables	6.7
17	*Geopora arenicola* (Lev.)	Pyronemataceae	Kundi	F	Feb-March	2	Whole fruiting body is cooked as vegetables	30
18	*Indigofera cassioides* DC	Leguminosae	Kathi	S	June-Sep.	1,3,5	Leaves as a vegetables, shoots are used as toothbrush	3.3
19	*Juglens regia* L	Juglandaceae	Khod	T	Aug.-Sep.	4	Fruits are eaten raw, used in chutney, raita.	70
20	*Malva parvifolia* L.	Malvaceae	Sonchal	H	May-Aug.	2,4,5	Leaves cooked as vegetables	26.7
21	*Mentha longifolia* (L.) L.	Lamiaceae	Jungli pootna	H	July-Oct.	2,5	Leaves used in making chutney, tea.	46.7
22	*Mentha piperata* L	Lamiaceae	Pootna	H	June-Oct.	2,4	Leaves used in chutney, herbal tea, raita and for flavouring	53.3
23	*Morchella esculenta* Linn.	Helvellaceae	Guchhi	F	Feb-April	2	Fruitification is used as vegetables	66.7
24	*Morus alba* Linn.	Moraceae	Toot	T	April-June	1,4	Fruits are eaten raw	60
25	*Oxalis corniculata* L.	Oxalidaceae	Ammi	H	June-Sep.	2,4	Leaves cooked as vegetables	20
26	*Plantago lanceolata* L.	Plantaginaceae	Chamchi pattar	H	April-Aug.	2,3,4	Leaves cooked as vegetables	10
27	*Plantago major* L.	Plantaginaceae		H	June-Sep.	2,3,4	Leaves cooked as vegetables	3.3
28	*Phytolacca acinosa* L.	Phytolaccaceae	Sorrel Saag	H	June-Aug.	2,3,5	Leaves cooked as vegetables	20
29	*Prinsepia utilis* Royle	Rosaceae	Rowari	S	July-Sep.	1,5	Oil is extracted from seed	10
30	*Punica granatum* Linn.	Punicaceae	Darooni	S	Aug-Oct.	1,3,5	Fruits are eaten, raw also used in chutney	60
31	*Pyrus pashia* Ham.	Rosaceae	Kainth	T	July-Sep.	1,5	Fruits are eaten raw	46.7
32	*Rhododendron arboretum* Sm.	Ericaceae	Chew	T	April- May	3,5	Flowers are used in tea, sharbat and raita	23.3
33	*Rosa brunonii* Lindl.	Rosaceae	Kareer	S	June-Sep.	1,3,5	Arial shoots are eaten raw, Flowers used in tea.	13.3
34	*Rubus ellipticus* Smith	Rosaceae	Peele aankhre	S	June-Aug.	1,3	Fruits are eaten raw	60
35	*R. niveus* Thunb	Rosaceae	Khiaari	S	July- Aug.	1,5	Fruits are eaten raw	63.3
36	*Rumex obtusifolious* L.	Polygonaceae	Albal	H	June-Sep.	2,4	Leaves cooked as vegetables	33.3
37	*Rumex nepalensis* Spreng.	Polygonaceae	Ulbul	H	May-June	2,4,5	Leaves cooked as vegetables	33.3

38	*Rumex hastatus* D.Don.	Polygonaceae	Badi Ammi	H	May-Oct.	1,5	Leaves used to make chutney.	30
39	*Solanum villosum* Mill	Solanaceae	Kayan kothi	H	June-Sep.	1,2,3	Fruits are eaten raw	50
40	*Solena amplexicaulis* (Lam) Gandhi	Cucurbitaceae	Ban kakkru	C	July- Aug.	3,4	Fruits are eaten raw	20
41	*Taraxacum officinale* (L.) Weber	Asteraceae	Dudhli	H	March-June	2,3,4,5	Leaves cooked as vegetable; flowers used in tea preparation.	10
42	*Trifolium pretense* L.	Leguminosae	Shataala	H	May-Aug	2,4	Leaves cooked as vegetables	6.7
43	*T. repens* L.	Leguminosae	Nikka Shataala	H	Aug.-Sep.	2,4,5	Leaves cooked as vegetables	3.3
44	*Urtica dioica* L.	Urticaceae	Kali saddar	S	June-Sep.	4,5	Leaves cooked as vegetable	13.3
45	*Viburnum grandiflorum* Wallich ec DC	Adoxaceae	Teldi	S	June-Aug.	2,3,5	Fruits are eaten raw; Arial shoots are used as toothbrush.	73.3
46	*Viola odorata* L.	Violaceae	Banafsha	H	April-Aug.	2,5	Flowers are used in tea	40
47	*V. pilosa*	Violaceae	Banaksha	H	March-April	2,3	Flowers are used in tea & raita	36.7

H=Herb, S=Shrub, T=Tree, C=Climber, Fn =Fern, F=Fungi, 1= Road side, 2= Moist shady places, 3= Exposed slopes, 4= Agricultural field, 5= Forest edges.

Identification

The collected plants were identified with the help of published floras and literature i.e. Flora of British India by Hooker [32], Flora of Udhampur by Swami and Gupta [33], Flora of Jammu and Plants of neighbourhood by Sharma and Kachroo [34], Forest Flora of Srinagar and Plants of neighbourhood by Singh and Kachroo [35]. Further cross checked and confirmed the identification from the Herbarium of Department of Botany, University of Jammu, Jammu (J&K).

Result and Discussion

A total of 47 Wild edible plants belonging to 28 families and 39 genera have been recorded as wild vegetables and fruits of nomads, semi-nomads and inhabitants of the Latti-Dudu valley of District Udhampur. The botanical name, family, local name, time of availability, habitat, part/s used and mode of utilization of each species have been enumerated in Table. 2. Out of total 47 Wild Edible Plants, 43 were angiosperms, 2 species were fungi and 1 belonged to pteridophytes.

A total of 5 habitats i.e. Road side, shady moist places, exposed slopes, agricultural fields and forest edges have been observed. The representation of species is maximum in shady moist places (24 species) followed by forest edges (23 species), agriculture field (16 species each), on road sides and exposed slopes (17 species each). Among all the species, 15 are represented in 3 or more than 3 habitats and the remaining restricted to 1 or 2 habitats only (Fig.2).

In term of number of species, Rosaceae was the dominant family that represents 6 species, followed by the Polygonaceae represented by 5 species while Moraceae and Leguminosae represented 3 species each. Amaranthaceae, Asteraceae, Urticaceae, Lamiaceae, Plantaginaceae and Violaceae were contributed 2 species each and rest 18 families have single species each in the present study. Among the genera, *Rumex* (3 species), *Ficus*, *Mentha*, *Plantago*, *Rubus*, *Trifolium* and *Viola* (2 species each) were dominant genera (Fig. 3). The growth form analysis of Wild Edibles revealed that herbs constituted the highest proportion being represented by 27 species (57.4%), shrubs represented by 9 species (19.1%), trees represented by 7 species (14.89%), climber 1 species (2.12%) while there were 1 species (2.12%) of fern and 2 species (4.25%) of fungi (Fig. 4). The time and frequency of collecting various edible plants and plants parts varied from plants to plants depending upon their availability. Method of preparation and uses of Wild Edible Plants have grouped by the locals into two categories- made into vegetables and consumed as raw. Most of the fruits were consumed as raw except fruits of *Ficus carica* and *F. palamata* which were cooked as vegetables and Most of the Leaves of plant species were used as vegetables. Leaves was the most frequently used part (20 species), followed by raw fruits (15 species), flowers (5 species), shoots (4 species), seeds & whole plants (3 species each) and rhizome (1 species) (Fig. 5). Other than consumed as raw and vegetables, dry rhizome of *Bistorta amplexicaulis*, leaves of *Menth spp*., flowers of *Rhododendron arboreum, Rosa brunonii and Taraxacum officinale* were used in preparation of tea. Leaves of *Mentha longifolia* and *Rumex hastatus*, fruits of *Juglens regia* and *Punica granatum* were used in making chutney whereas fronds of *Diplazium esculentum* was used in making pickles etc.

Plants like *Morchella esculenta*, *Viola odorata*, *Diplazium esculentum*, *Geopora arenicola* and *Polygonum amplexicaulis* are gathered by shepherds from forests while they are with their herd of cattle. They are easily sold in the local market and become source of livelihood for locals especially the women folk. Some other identified edible plants in the market are *Amaranthus viridis*, *Diospyros lotus*, *Punica granatum*, *Morchella esculenta*, *Morus alba*, *Mentha sps.*, *Juglens regia* and *Viola sps. etc*. and provide opportunity to additional household income.

According to the frequency index, *Berberis lycium* and *Viburnum grandiflorum* were the most used plant species, having a frequency index 73.3% each, while *Indigofera cassioides*, *Plantago major* and *Trifolium repens* were the least utilized with frequency index of 3.3% each (Table.1)

During survey, it was observed that the locals of the study area are dependent on forest for food. They have much faith in using wild plants as food. Wild edible plants are used as common household foods and make a substantial contribution to food security of the people of the area. Many of the wild foods may not freely available in future due to various human activities. The major activities threatening edible plants are overexploitation of forest products, habitat destruction, uncontrolled fire setting, overgrazing and invasion of exotic plant species. Therefore, efforts can be made to bring some of them under cultivation in order to maintain a continuous supply and reduce the pressure from the natural habitats.

Table 2: Profile of the informants of Latti- Dudu Valley of District Udhampur

S/N	Informant Name	Sex	Age	Profession	Village	Tribe/Community
1	Mohd Sharief	M	75	Local Hakeem	Latti	Inhabitant
2	Bali	M	40	Farmer	Bari	Semi-nomad
3	Naseer Hussain	M	50	Shopkeeper	Dhuna	Inhabitant
4	Wazir Mohd	M	63	Rtd ZEO	Dhuna	Inhabitant
5	Leello	M	60	Shepherds	Nadhraat	Semi-Nomad
6	Parveena	F	61	Hakeem	Latti	Inhabitants
7	Nathu	M	80	Shepherds	Shivgali	Semi-Nomad
8	Amarnath	M	85	Shepherds	Tadbug	Semi-Nomad
9	Rashida	F	68	Housewife	Latti Dhuna	Inhabitant
10	Shivu	M	62	Shepherds	Sira	Nomad
11	Kamlo Devi	F	46	Farmer wife	Jakhed	Nomad
12	Ramellu	M	75	Local Hakeem	Latha	Semi-Nomad
13	Mohan Lal	M	45	Farmer	Latha	Inhabitant
14	Gurshar	M	58	Shepherd	Marothi	Nomad
15	Maroofa	F	21	Shepherd	Maroothi	Nomad
16	Mohd Ali	M	54	Shepherd	Marothi	Nomad
17	Bihari Lal	M	27	Farmer	Pouna	Inhabitant
18	Tariq	M	50	Naib Sarpanch	Latti	Inhabitant
19	Bimla Devi	F	51	Shepherd	Booghal	Semi-nomads
20	Onkar Nath	M	61	Farmer	Dudu	Inhabitant
21	Pindi Ram	M	75	Farmer	Chappar	Semi-Nomad
22	Beer Bal	M	56	Farmer	Pattan	Semi-Nomad
23	Bishan Das	M	55	Farmer	Pattan	Inhabitant
25	Angrez singh	M	54	Ex Sarpanch	Koi	Inhabitant
26	Shamim	F		Farmer wife	Kirchi	Semi-Nomad
27	Sofiya Begum	F	76	Farmer wife	Jakhed	Semi-Nomad
28	Choru Ram	M	47	Farmer	Kathal	Semi-Nomad
29	Mohd Ali	M	59	Farmer	Krchi Dudu	Semi-nomad
30	Zakiya	F	56	Farmer wife	Dudu	Semi-nomad

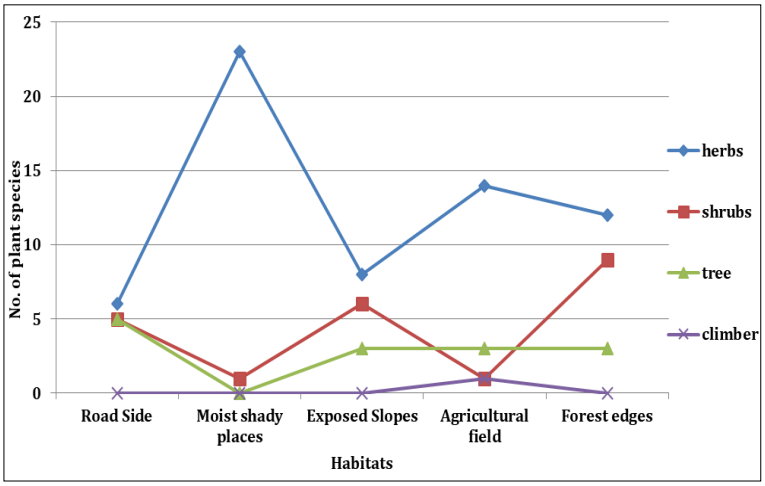

Fig 2: Life forms recorded in different habitats

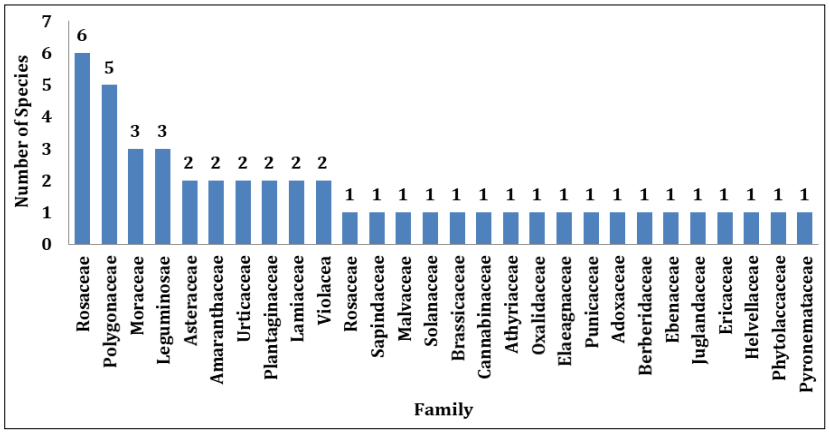

Fig 3: No. of Wild Edible Plants of various families used by the locals of Study area.

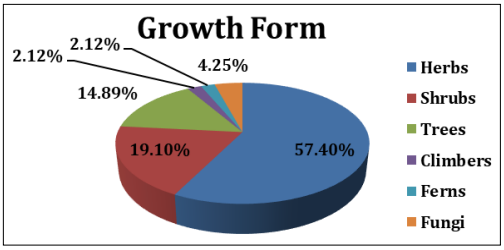

Fig 4: Growth form of Wild Edible Plants used in study area.

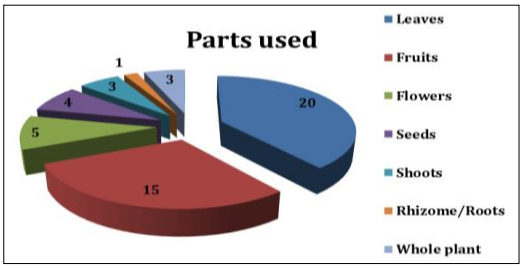

Fig 5: Different parts of Wild Edible Plants used

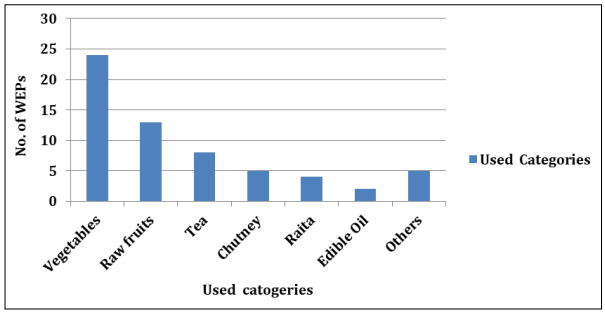

Fig 6: Utilization pattern of Wild Edible Plants

Fig 7: A)- Raw fruits of *Rubus niveus* Thunb; B)-Raw fruits of *Solanum villosum* Mill ;; C)- Raw fruits of *Viburnum grandiflorum* Wallich ec DC; D)- Dry rhizomes of *Bistorta amplexicaulis* ; E)- Raw fruits of *Elaeagnus parvifolia* Wall.ex Royle; F)- Raw fruits of *Berberis lycium* Royle; G)- Inflorenence of *Phytolacca acinosa* L; H)- Local woman on his way to home after collecting the leaves of *Phytolacca acinosa* L. from forest area; I)- Interviewing the old man of Gaddi tribe; J)- Interviewing the old man of Bakerwal tribe; K)-Pickle of frond of *Diplazium esculentum* (Retz) Sw.; L)- Interaction with family of a Gujjar tribe.

Conclusion

The majority of the population of study area is comprised of nomadic and semi-nomadic tribes like Gujjar, Bakerwal, Gaddi and other local communities. They are very close to the nature as they are living in the vicinity of forest and spent most of their time with livestock in pastures. They migrate from lower down areas to higher reaches in search of fodder and quality grazing lands. During migration, they depend on local wild edible plants for their food. Study revealed that the traditional knowledge of use of wild edible is still prevalent among the ethnic communities of the study area. High frequency index of Wild Edible Plants shown that the people of all groups of study area are much aware about the traditional uses of wild edibles. Unfortunately, overgrazing, deforestation activities and the changing climatic conditions have made availability of wild edible plants as a scarce resource to the tribal communities. Therefore, there is an urgent need to take action and create awareness among the locals about the conservation of local flora as well as traditional knowledge of their utilization. Cultivation of wild edible plants should be encouraged in order to relieve the pressure on wild plants. It is hoped that study will provide useful information on the conservation and sustainable use of the natural resources of the area.

The findings suggest further investigation into nutritional profile, processing methods, cultivation techniques, conservational studies and pharmacological properties of the reported plants species.

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