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P. P. Chauhan
LBS Govt. Degree College, Saraswati Nagar, Distt. Shimla, HP. India.

Correspondence:
P. P. Chauhan
LBS Govt. Degree College, Saraswati Nagar, Distt. Shimla, HP. India.

Ethnobotanical studies of Wild edible plants used by ethnic people in Pabbar valley, district Shimla, Himachal Pradesh.

P. P. Chauhan

Abstract
This research paper describes the list of wild edible plants used by local communities in Pabbar valley, district Shimla, Himachal Pradesh. The information on wild edible plants was gathered from local inhabitants through interviews, group discussions, observations, and free listing. A total of 38 plant species belonging to 27 families, 34 genera were found edible in the present study. Rosaceae, Asteraceae, and Polygonaceae were reported to be the dominant families. The herbs (28 species) were the dominant life form. The leaves of 20 species, seeds of 8 species, roots, bulb and fruits of 3 species each were the primary parts used for consumption. There were 9 primary preparation and consumption methods reported; such as cooked vegetables, eaten raw, chutney, medicinal tea, draught food, oil, spice or flavour enhancer, Juice and beverage. The four plant species viz., *Diplazium esculentum* Retz. (vegetable), *Trillium govanianum* Wall ex D. Don, *Aconitum violaceum* Jacf. ex Staf and *Asparagus adscendens* Roxb. (medicinal) were also traded in the markets. Promoting the use of wild edible among the younger generation is essentially required to protect the traditional knowledge as it serves a readily available nutritious food at the time of food crisis such as famine, drought and food shortage.

Keywords: Ethnobotany, Traditional use, Wild Edible Plants (WEPs), Consumption pattern, Pabbar Valley.

Introduction
Wild edible food plants play a very important part of the human diet and livelihood of the poor rural communities. Wild foods are food products obtained from non-domesticated species, harvested or collected from the wasteland, agricultural fields, water bodies and forest for human consumption. The collection and use of wild food plants by the communities living in vicinity of forest areas have been in practice since ages all over the world. Wild edible plants are an important source of vegetables, fruits, tubers and nuts which are relevant for these people in ensuring food security and nutritional value of diet[1]. There are over 20,000 species of wild edible plants in the world, yet fewer than 20 species provide 90% of our food[2].

Food insecurity and malnutrition remain some of the most fundamental challenges facing the world especially the under developed countries. The recent data shows a rise in world hunger levels, reversing a long downward trend. According to the latest estimates by FAO, about 821 million people in the world are chronically undernourished, up from 804 million in 2016[3].

The use of wild edible food contributes to the diets of millions of people, particularly in terms of micronutrients [4, 5]. Several factors are responsible for selecting and use of particular wild edible plants. The preference depends on availability, abundance, cultural preference, economic conditions, climatic conditions, and shortage period. There is an increased demand to adopt a wider approach to human nutrition than the conventional agricultural model allows. The awareness and importance of local species play a vital role in the consumption of wild species in achieving balanced nutrition. The diversity in wild plant species contributes to household food security and health[6].

The Pabbar valley is a part of district Shimla in Himachal Pradesh. The valley is located in Western Himalayas. The valley is undergoing a socio-economic transition phase due to the introduction of horticultural cash crops. Indian Himalaya alone host 675 edible wild plant species and Himachal Pradesh being part of it and has a rich diversity of wild edibles [7,8,9]. The dependence on wild food plants and the use of traditional meals appears to have reduced considerably in recent years. The neglect may be attributed to several reasons like urbanization, modernization, a transition towards so-called "Western" diets. The awareness and understanding of these plants are rapidly eroding among the new generation. Hence it is of utmost importance to obtain data about the popular use of such plant species before this knowledge disappears completely. This paper is an attempt to document the wild edible food plants collected and consumed in Pabbar Valley of Shimla district and to fill the gap in the context of existing data available on wild edible plants in Western Himalaya.

Materials and methods

Study area

The study was conducted in Pabbar Valley of District Shimla, Himachal Pradesh. The valley is known for its ethnic identity having rugged mountains, naturally long and open pastures at the high area, with elevation ranging from 1200m to 5200m. The area is located between 77^0 29'40" to 78^0 18'42" and 30^0 57'0" to 31^0 25' 20" North in Rohru Sub-division consisting of three different blocks Jubbal, Rohru, and Chirgaon. The study area shares its border with the tribal district of Kinnaur and Uttarakhand State.

The climate of the region ranges from Sub-temperate to Alpine. The area has an average rainfall of 1310.8 mm mostly in July & August. The maximum temperature during summer rises to 35^0 C and winters are very cold with the temperature falling to subzero and most of the area remains snow covered. The villagers are very simple, hardworking with agriculture and animal husbandry as a primary source of food and income.

Field data collection

The present study was conducted to explore and identify the wild edible plants except for fruits and record the indigenous knowledge of utilization of these resources. The use of fruits has been provided in a separate publication by the authors[10]. The information was gathered from 67 informants including both male and female individuals. The ages of informants were between 29 to 83 years. The informants were briefed about study requirements and prior oral consent was taken from the informants about sharing the knowledge. The information was gathered by conducting interviews, group discussions, free listing, and field observations. The informants were asked to share the knowledge about the common name of wild edible plant species, the place where species were gathered, life form, plant part used, mode of consumption and frequency of use. The specimens of plants were photographed, collected from the study site, preserved as herbarium sheets after mounting on standard herbarium sheets[11]. The plants were identified with the help of existing standard literature available on the flora of the region [12,13,14,15] and deposited at Lal Bahadur Shastri Govt. Degree College Saraswati Nagar, Distt. Shimla, H.P. The correct names of the plant species and families were further verified following the website; http://www.theplantlist.org/.

Data analysis

The analysis of information on data reported on wild edible plants and indigenous knowledge was done on life form, mode of consumption, frequency of use, plants part used, most reported family, genus & species and taxonomic diversity.

Results

Taxonomic Diversity of Wild Edible Plants

The use of 38 wild edible plants from 34 genera and 27 families were recorded in the study area (Table.1). The families with the largest representation was Rosaceae (4 species) followed by Asteraceae and Polygonaceae (3 species) each, Amaryllidaceae, Chenopodiaceae, Lamiaceae, Urticaceae (2 species) each and the remaining 20 families were represented by a single species each.

Table 1: Wild edible plants of Pabbar Valley, District Shimla, (H.P.).

Sr. No	Botanical Name	Family	Local Name	Part Used	Usage pattern	Frequency of Use
1	*Aconitum violaceum* Jacf. ex Staf	Ranunculaceae	Dudi Mora	Roots	Roots are sweet in taste, eaten raw .The root powder is used as a food adjunct.	Occasionally
2	*Aesculus indica* (Wall. ex Camb.) Hook	Hippocastanaceae	Kanor	Seeds (Kernels)	Kernels dried and ground into flour.Flour is directly used in making Halwa (pudding) or mixed with Fagopyrum flour to make bread (chapatti).	Occasionally
3	*Allium carolinianum* DC.	Amaryllidaceae	Jangli Lahsun	Leaves, bulbs	Leaves& bulbs are cooked as vegetables.	Occasionally
4	*Allium wallichi* Kunth.	Amaryllidaceae	Duna	Leaves, Bulbs	Leaves & bulbs are added as flavouring agent.	Occasionally
5	*Amaranthus caudatus* L.	Amaranthaceae	Chulai	Leaves	Fresh leaves are cooked as vegetable.	Frequently
6	*Angelica glauca* Edgew.	Apiaceae	Chura	Roots	Dried root powder is added to pulses to increase flavour.	Rarely
7	*Asparagus adscendens* Roxb.	Asparagaceae	Satjari	Tubers	Tubers are cooked as vegetable.	Rarely
8	*Berberis aristata* DC.	Berberidaceae	Karmashal	Leaves	Young leaves are edible.	Rarely
9	*Cannabis sativa* L.	Cannabaceae	Bnang	Seeds	Seeds raw or fried are edible. Edible oil is extracted from seeds.	Occasionally

10	*Chenopodium album* L.	Chenopodiaceae	Bathu	Leaves, seeds	Fresh leaves are cooked as green vegetable.	Frequently
11	*Chenopodium ambrosioides* L.	Chenopodiaceae	Banbathu	Leaves	Fresh leaves are cooked as vegetable.	Frequently
12	*Cirsium arvense* (L.) Scop.	Asteraceae	Bhungshee	Roots	Young and soft roots are eaten raw.	Occasionally
13	*Diplazium esculentum* Retz.	Athyriaceae	Lingra	Leaves (Fronds)	Young fronds after cleaning are cooked as vegetable.	Frequently
14	*Fagopyrum esculentum* Moench	Polygonaceae	Oagla	Leavesseeds	Leaves are cooked as mixed potherb with other leafy green vegetables to improve taste. Seed powder (Flour) is used in making 'lauta' (type ofbread).	Frequently
15	*Ficus palmate* Forsk	Moraceae	Pheru	Fruits	Fruits are cooked as vegetable.	Occasionally
16	*Girardinia diversifolia* (Link) Friis.	Urticaceae	Kalur	Leaves	Leaves after removing stings are cooked as vegetable.	Discontinued
17	*Mentha spicata* L.	Lamiaceae	Pudina	Leaves	Leaves are used for making chutney and flavouring food.	Frequently
18	*Nasturtium officinale* R.Br.	Brassicaceae	Chala	Leaves, young shoots	Leaves and young shoots are cooked as vegetable	Frequently
19	*Papaver macrostomum* Boiss. & A. Huet.	Papaveraceae	Jangli Post	Young Leaves	Young leaves are directly edible.	Occasionally
20	*Phytolacca acinosa* Roxb.	Phytolaccaceae	Jalga	Leaves	Young & immature leaves are cooked as vegetable.	Frequently
21	*Prinsepia utilis* Royle	Rosaceae	Bhekal	Seeds	Oil extracted from seed is used for cooking or lightening lamp.	Rarely
22	*Prunus armeniaca* L.	Rosaceae	Shada , Chulti	Fruits, seeds	Seeds yield an edible oil. Fruits are brewed to country liquor.	Frequently
23	*Prunus mira* Koehne	Rosaceae	Behmi	Fruits, seeds	Fruits are crushed to make chutney called "baimod". Oil extracted from kernels is used as cooking and hair oil .Fruits are brewed to make country liquor.	Occasionally
24	*Rhododendron arboreum* Smith	Ericaceae	Buransh	Flowers	Petals are edible, also used in making juice and chutney.	Occasionally
25	*Rosa canina* L.	Rosaceae	Kuja	Young shoots	Young shoots after peeling are edible.	Rarely
26	*Rumex hastatus* D.Don	Polygonaceae	Malodi	Leaves	Leaves are crushed to make chutney by adding salt and chillies. Used as instant food supplement. Young leaves are eaten raw.	Occasionally
27	*Rumex nepalensis* Spreng	Polygonaceae	Malora	Leaves	Leaves are crushed to make chutney. Young leaves are eaten raw.	Occasionally
28	*Silene vulgaris* (Moench) Garcke	Caryophyllaceae	Phuphani	Leaves	Leaves are used as vegetable.	Frequently
29	*Sonchus asper* Hill	Asteraceae	Dudhali	Buds	Buds are eaten raw.	Rarely
30	*Taraxacum officinale* (L.) Weber ex F.H.Wigg.	Asteraceae	Katshersha	Buds, leaves	Buds are eaten raw. Leaves are cooked as vegetable.	Frequently
31	*Taxus wallichiana* Zucc.	Taxaceae	Thuna , Birmi	Bark, Needles	Bark & needles are used in making tea.	Occasionally
32	***Thymus linearis* Benth**.	Lamiaceae	Lepte	Leaves	Leaves are added to tea to increase flavour.	Occasionally
33	*Trillium govanianum* Wall ex D.Don	Triliaceae	Satva	Rhizome	Root powder is added to food to increase flavour .	Occasionally
34	*Tulipa stellata* Hook	Liliaceae	Peinpee	Bulb	Raw bulbs are edible.	Occasionally
35	*Typhonium diversifolium* Wall. ex Schott.	Araceae	Chamush	Tuber	Tubers are grinded to paste and made into small slab and swallowed directly due to its astringent property. Used as drought food.	Discontinued
36	*Urtica dioica* L.	Urticaceae	Kungshi	Leaves	Young leaves after removing stings are used as vegetable.	Discontinued
37	*Viola canescens* Wall.	Violaceae	Banafsha	Flowers	Flowers are added to tea to increase flavour and used as medicine against cough and cold.	Occasionally
38	*Zanthoxylum armatum* DC	Rutaceae	Timur	Seeds	Seeds are added to pulses to increase flavour. Seeds are also consumed raw.	Occasionally

The life form analysis revealed that the majority of wild edible plants consumed were herbs (28 species), followed by trees (6 species) and shrub (4 species). Only one species of Pteridophyte (herb) was reported in use (Fig.1).

With regards to the plant part used, 11 edible parts were recorded. The leaves were the largest category (43%) followed by seeds (17%), roots, fruits and bulbs (7%) each, tubers, buds, flowers and young shoots (4%) each and rhizome and bark (2%) each. More than one part of several species was reported to be consumed, for example, Taraxacum officinale (L.) Weber ex F.H.Wigg (buds & leaves), Taxus wallichiana Zucc. (Bark and needle), Fagopyrum esculentum Moench , Chenopodium album L. (leaves & seeds), Nasturtium officinale R.Br. (Leaves & young shoot) and Allium spp. (leaves & bulbs). (Fig.2).

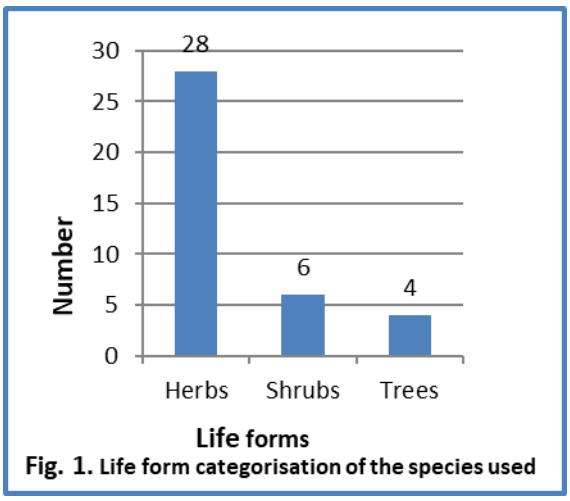

Fig. 1. Life form categorisation of the species used

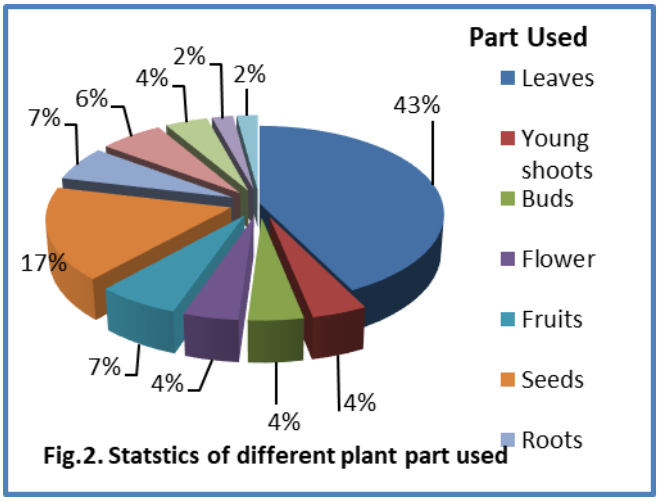

Fig.2. Statstics of different plant part used

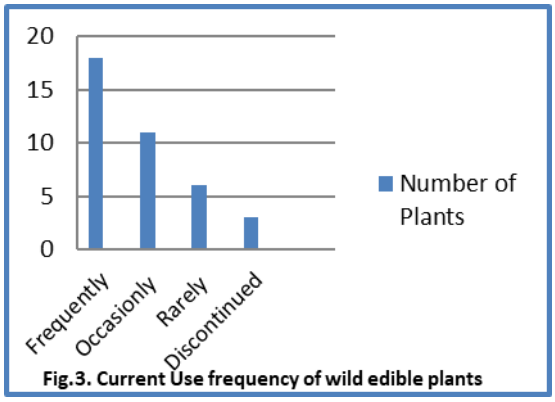

Fig.3. Current Use frequency of wild edible plants

The preparation and consumption pattern of WEPs

Primary foods

There were 9 primary consumption patterns of wild edible plants in the Pabbar valley reported by informants (Table. 1). A total of 38 species were used as the primary food and the most common use patterns were cooked as a vegetable (14 species), consumed as raw (13 species), spice & flavour enhancer (5 species), chutney (4 species), tea (3 species), drought food (3 species), oil (4 species), beverage (2 species) and juice (1 species). The raw consumed species (9) mostly use tender shoots, buds, raw roots and leaves. Out of 38 reported species, 18 species were used occasionally, 11 species frequently and 6 species rarely. The use of 3 species had discontinued in the area (Fig.3).

A large number of the wild edible plants (37%) were usually used as mixed potherbs. The young leaves after collection is thoroughly washed, chopped and cooked after frying in oil. The tubers are also eaten after cooking. A large no of wild edible plants (34 %), with their edible parts such as buds, leaves, young shoots, petals, bulbs, and roots are eaten raw. For example, Sonchus asper Hill and Taraxacum officinale (L.) Weber ex F.H.Wigg. (buds), Rosa canina L. (young shoots after peeling), Rumax spp. Berberis aristata DC, Papaver macrostomum Boiss. & A. Huet. (Young leaves), Tulipa stellata Hook (bulb) and Rhododendron petals are consumed raw.

Tea prepared from three species has medicinal properties, for example, bark of Taxus wallichiana Zucc. (anticancer), leaves of Thymus vulgaris L. (fever and cough) and flowers of Viola canescenes Wall. (fever). Four species viz., Allium wallichi Kunth. (leaves), Aconitum violaceum Jacf. ex Staf , Angelica glauca Edgew (root) and Zanthoxylum armatum DC (seed) are used as flavour enhancers. Allium wallichi Kunth leaves are added to curry to enhance the taste. The root powder of Angelica glauca Edgew and Aconitum violaceum Jacf. ex Staf are added to pulses (dal) to increase flavour and improve digestion. The seeds of Zanthoxylum armatum DC are added as flvouring agents in cooked food. Seeds and twigs of these plants are also helpful in relieving dental pain.

Three species viz., Aesculus indica (Wall. ex Camb.) Hook, Typhonium diversifolium Wall. ex Schott. and Cirsium arvense (L.) Scop. have been used as drought food. The kernels of Aesculus indica Wall. ex Camb.) Hook was dried and ground into flour. Flour is used in making Halwa (pudding) or mixed with other flour to increase volume and nutritive value. Typhonium diversifolium Wall. ex Schott tubers are ground to a paste and made into small slabs of 1cm to 2cm and swallowed directly.

The oil extracted from Prunus armeniaca L. and Prunus

mira Koehne is still valued in the region due to its multiple uses; cooking, massage, hair oil and tonic. Fruits of these two species are also brewed to country liquor (Govt. permission required). Cannabis sativa L. a multi-utility plant also yields edible oil. The petal of Rhododendron arboreum Smith flowers are edible and used in making chutney and juice.

Discussion

The wild edible plants are greatly valued throughout the Himalayan region and serve as an important source of nourishment for local people. The studies made so far on wild edible plants of Himachal Pradesh provide a wide diversity of plants (e.g. herbs, shrubs, trees and climbers) with edible parts (e.g., leaves, roots, tubers, seeds, buds, flowers & fruits). The present study describes the details of these plant species from Pabbar valley of district Shimla, H.P. - so that a complete database of wild edible plants from Himachal Pradesh could be built through a series of such studies.

The informants revealed that they were still using wild food plants for household consumption seasonally either raw or cooked. It was also found that consumption pattern was also associated with economic conditions of the local communities. The female was especially involved in the collection of wild food plants during working in the fields and have a better knowledge of these plants than their counterparts. It was found that the collection period for green vegetables ranges from March to June and for some wild edible plants extended up to October. This was similar to the seasonal ontogeny of wild food plants in the Northern Hemisphere [16,1].

The leafy vegetables (43% in the present study) collected in the wild have more nutrients than the cultivated species. A research study conducted on wild edible plants shows that these plants are rich in carbohydrates, proteins, vitamins and mineral salt[17]. The plants are useful in maintaining good health and prevent various diseases [18,19].

The wild food plants consumed raw were used as supplementary foods during adversity such as famine, drought, and hunger [20]. A good number of 34% were taken raw during collection of fuel, fodder, and livestock grazing in the forest by adults or by children while playing as a leisure food to satisfy instant hunger.

Wild edible plants are also used as medicine worldwide. A high number (38%) in the present study have been reported by the informants to be used for food as well as for medicinal use. The overlapping between traditional food and medicine is well known worldwide [21]. For example, tea prepared from *Taxus* bark has anti-cancerous properties. Trillium govanianum Wall ex D.Don and Aconitum violaceum Jacf. ex Staf roots were added to pulse (dal) to have better flavour and they were perceived as a tonic and strengthen the digestive system. The medicinal property of these wild edible was also reported by others in Himalayan region [22,23,24]. Trillium plants were heavily exploited in their natural settings due to the huge demand for this species in the market for its steroidal properties.

The use of three species viz., Typhonium diversifolium Wall. ex Schott. , Girardinia diversifoila (Link) Friis. and Urtica dioca L. had discontinued in the region, the reason may be bad taste or species were considered as poor man's food.

Most of harvesting practices have effects on plant populations but with different degrees of threat to each species [25]. The most of harvesting methods used for the collection of edible plant parts in the present study do not pose much threat to wild edible plants, but the destructive collection of two species viz., Diplazium esculantum Retz.sold in market for consumption and Trillium govanianum Wall ex D.Don traded for its roots needed to be regulated.

Food habits and preparations are never static. Health-conscious people are searching for new natural health foods or organic foods throughout the world [26]. Local wild edible plants can serve this purpose. Many wilder edibles can be added to the list and sold in the market or to tourists as natural food which will enhance the earning of poor rural people and add to the health benefits of tourists.

Conclusion

The present survey shows that the traditional knowledge on the use of wild edible plants is still in practice in Pabbar Valley. The wild food plants were collected by villagers while doing routine activities like farming, visiting forests for fuelwood and fodder collection, or grazing their live stocks. The wild edible plants reported in the present study showed similar use patterns as by the people of other parts of western Himalayas with few differences like the use of Typhonium diversifolium which was rarely reported. Unfortunately, lesser-known wild food plants, a rich source of micronutrients available at the doorstep are being neglected with the passage of time and their traditional knowledge is also eroding. Easy access to the vegetable market is another cause for the loss of interest in these wild edibles. The documentation, conservation and promotion of the use of these plant in the younger generation are essential as they serve as readily available green vegetable food at the time of food crisis such as famine, drought, food shortage, or epidemic outbreak when the supply chain of vegetable is completely stopped in rural and interior areas. More investigations on the nutraceutical potential, distribution patterns and regeneration are also needed to assure sustainable supply in the future.

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