

WILD EDIBLE PLANT GENETIC RESOURCES FOR SUSTAINABLE FOOD SECURITY AND LIVELIHOOD OF KINNAUR DISTRICT, HIMACHAL PRADESH, INDIA

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Abstract

In view of changing food habits of local communities of Himachal Himalaya, a study to document the genetic resources of wild edible plant and traditional recipes was conducted in Kinnaur district of Himachal Pradesh, India. Rituals and cultural beliefs of the local people of Kinnaur plays significant role in conserving biodiversity. A total of 116 plant species belonging to 42 families were recorded from the study area. Among the four major life forms, herbs contributed the highest proportion of the edible species (57) followed by trees (32), shrubs (26) and climber (1). Fruits (50) are the highly consumed plant parts, followed by leaves (33), seeds (23), bulbs (6), resin/gum (6), roots (5), flowers (4), shoots (4), bark (2) and tubers (2) respectively. Chilgoza nut is the dominant wild edible and also the main source of revenue. This includes 13 threatened species under different Red List categories of IUCN 2000 and 8 species are endemic to Western Himalayas. Allium stracheyi, Angelica glauca, Betula utilis, Bunium persicum, Dioscorea deltoidea, Hippophae spp., Juglans regia, Pinus gerardiana, Prunus armeniaca, Prunus mira and Sinopodophyllum hexandrum are highly exploited species in wild and need to be conserved.

Keywords: Kinnaur; Himachal Pradesh; Wild edible; Genetic Resource, Conservation.

Introduction

Wild plants have been used as a source of food, medicine and many other requirements of life since time immemorial. The rural communities in India have rich knowledge of wild edible plants and its utilization is still an integral part of the different cultures in the country. They collect and preserve these locally available wild and cultivated plant species for their day to day life even today [1]. Sometimes the nutritional value of traditional wild plants is higher than several known common vegetables and fruits [2-4]. People have recently realized the importance of such plants in rural economy and may have the potential as valuable food sources and could be part of a strategy in tackling food insecurity [5]. Therefore, there has been a revival of interest in survey, identification and documentation of wild edible plants during the last few decades. It become more popular throughout the world in determining nutrient values of some widely used plants and assessing country's forest genetics resources [6].

A perusal of the literature reveals that, many publications have emphasized the diversity and value of wild edible plants from North Western Himalaya in India [7-11]. Mehta *et al.* [12]

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reported wild edible plant species for subsistence in Kumaon Himalaya and associated traditional knowledge. The nutritive value of wild edible fruit *Hippophe rhamnoides* L. and their importance in the light of upcoming organic foods and nutraceutical industries was highlighted by Dhyani *et al.* [13]. Kala [14] reported a total of 23 cultivated food crops and 15 wild edible fruit species as the most preferred species by local people in different localities of the state Uttarakhand. Kumar and Hamal [15] recorded information on the edibility of 50 plants species used traditionally by local inhabitants in Kishtwar High Altitude National Park, Jammu and Kashmir and the species that is playing important role in income generation. Tiwari *et al.* [16] recorded 55 plant species consumed as vegetables and as raw wild edibles by the local people in the hilly areas of Alaknanda Valley, Uttarakhand State. Devi and Thakur [17] identified 25 species that are being used by inhabitant of cold desert of Lahaul and Spiti for various purposes. The study area, Kinnaur district, which has not yet been studied for wild edible plant resources except ethnobotany of medicinal plants [18] and enlisting the floristic elements [19]. Therefore, the study was designed to document the various wild edible plants consumed by the local populace in Kinnaur district, Himachal Pradesh.

Study Area

The district Kinnaur is inhabited by tribal group commonly known as *Kinnauras*, *Kanauras* or *Kinners* has a long tradition of using several plants based raw materials since ancient times and the main occupations are agriculture, horticulture and animal husbandry. It is the northeastern frontier district of Himachal Pradesh and a bordering district between India and Tibet, is located in the tottering heights of Great Himalayan mountain ranges covered with perpetual snow and having passes that remain inaccessible almost throughout the year. It is bounded on the north by Spiti, the south by Shimla district, on west by Shimla and Kullu districts of Himachal Pradesh; on the east by Tibetan territory and Uttarkashi district of Uttarakhand state. It is by and large secluded, rugged and mountainous to an extraordinary degree and lies on both sides of river Sutlej. It is situated between 31° 05' 50" and 32° 05' 15" North latitude and between 77° 45' 00" and 79° 00' 35" East longitude (Fig.1). This rugged landmass with uneven terrain is spread in 6,401 sq.kms and is stretched over about 80 kms in length and about 65 kms in breadth. The elevation of the region ranges varies from 1220 to 6,770 meters above sea level [20]. The annual rainfall varies from 46.51 to 92.72 cms with an average record snowfall of 2.16 meters per annum. The mean annual temperature of the region is 16.37° C and mean wind velocity is 3.02 kmph. The wind normally blows in North -Easterly direction.



Fig. 1. Study Area – District Kinnaur, Himachal Pradesh

As per the classification of *Champion and Seth* [21], Kinnaur district lies in the vegetation types ranging from sub-tropical pine forest to dry alpine scrub and cold desert. Due to its varied climatic and rugged topographical conditions, one can feel marked differences in the climate of the region ranging from the tropical heat in the lower valleys to the sub-zero bone chilling temperature in the higher reaches of Baspa valley and cold desert regions which is covered with snow during the winter seasons. A number of high altitude valuable medicinal plants species viz. *Aconitum heterophyllum* Wall. ex Royle, *Angelica glauca* Edgew., *Arnebia benthamii* (Wall. ex G.Don) I.M. Johnst., *A. euchroma* (Royle) I.M. Johnst., *Ephedra gerardiana* Wall. ex Stapf, *Heracleum candicans* Wall. ex DC., *Jurinea macrocephala* DC., *Picrorhiza kurrooa* Royle, *Polygonatum verticillatum* (L.) All., *Rheum australe* D.Don, *R. webbiana* Royle, *R. speciforme* Royle, *Seriphidium brevifolium* (Wall. ex DC.) Ling & Y.R. Ling, *Sinopodophyllum hexandrum* (Royle) T.S. Ying, etc. are also found in this region.

Methodology

The data were collected as per methodology suggested by Jain [22]. The information on wild edible plants were collected by interviewing the local people during field visits and relevant information pertaining to botanical name, family, local name, edible parts and mode of usage (Table 1). However, the vernacular name of the plants varies from valleys to valleys due to various dialects being spoken by the different villagers in the Kinnaur district. The voucher specimens of wild edible plant collected from different localities, and valleys of the district, which were identified with the help of standard floras [9, 23, and 24] and the herbarium at Himalayan Forest research Institute, Shimla.

Table 1. List of wild edible plants, families, its vernacular names and mode of usage

a. Fruits					
No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Berberis aristata</i> DC.	Berberidaceae	Kashmal, Chutrum	Shrub	Berries edible.
2	<i>Berberis chitria</i> Buch.-Ham. ex Lindl.	Berberidaceae	Chawa, Chutrum	Shrub	do
3	<i>Berberis glaucocarpa</i> Stapf	Berberidaceae	Chawa, Chutrum	Shrub	do
4	<i>Berberis jaeschkeana</i> C.K.Schneid.	Berberidaceae	Chawa, Chutrum	Shrub	do
5	<i>Berberis lycium</i> Royle	Berberidaceae	Kashmal, Chutrum	Shrub	do
6	<i>Capparis himalayensis</i> Jafri	Capparaceae	Kabra	Shrub	Fruits edible
7	<i>Castanea sativa</i> Mill.	Fagaceae	Mitha Khanor, Poo, Kapoo	Tree	do
8	<i>Celtis australis</i> L.	Ulmaceae	Khirk, Koo, Kru	Tree	do
9	<i>Chenopodium foliosum</i> Asch.	Chenopodiaceae	--	Herb	do
10	<i>Elaeagnus angustifolia</i> L.	Elaeagnaceae	Shiulik, Surch	Tree	do
11	<i>Elaeagnus parvifolia</i> Wall. ex Royle	Elaeagnaceae	Surch	Shrub	do
12	<i>Ephedra gerardiana</i> Wall. ex Stapf	Ephedraceae	Somlata	Shrub	do
13	<i>Ficus palmata</i> Forssk.	Moraceae	Phedu, Kock, Phegra	Tree	Fruits edible. Unripe fruits used for making vegetables
14	<i>Fragaria nubicola</i> (Lindl. ex Hook.f.) Lacaita	Rosaceae	Baley Bashu	Herb	Fruits edible.
15	<i>Fragaria vesca</i> L.	Rosaceae	Bruciley	Herb	do.
16	<i>Hippophae rhamnoides</i> L. subsp. <i>turkestanica</i> Rousi	Elaeagnaceae	Dhurchuk, Charma	Shrub	Fruits edible. Juice obtained from the fruits is used for making curries.
17	<i>Hippophae salicifolia</i> D.Don	Elaeagnaceae	Surch, Surchu, Charma	Tree	do
18	<i>Hippophae tibetana</i> Schldtl.	Elaeagnaceae	Surch, Surchu	Shrub	do
19	<i>Lonicera angustifolia</i> Wall. ex DC.	Caprifoliaceae	Kuchang	Shrub	Fruits edible.
20	<i>Lonicera angustifolia</i> var. <i>myrtillos</i> (Hook. f. & Thomson) Q. E. Yang, Landrein, Borosova & J. Osborne	Caprifoliaceae	Kuchang	Shrub	do
21	<i>Malus baccata</i> (L.) Borkh.	Rosaceae	Khontli	Tree	do
22	<i>Morchella esculenta</i> Fr.	Morchellaceae	Rangmu, Guchhi	Fungi	Fruitification is cooked for making delicious vegetables.

23	<i>Morus alba</i> L.	Moraceae	Shatoot	Tree	Fruits edible.
24	<i>Morus serrata</i> Roxb.	Moraceae	Himalayan Shatoot, Kinu	Tree	do
25	<i>Pistacia chinensis</i> subsp. <i>integerrima</i> (J. L. Stewart ex Brandis) Rech. f.	Anacardiaceae	Kakkar-singhi, Kakrian	Tree	Fruits edible.
26	<i>Sinopodophyllum hexandrum</i> (Royle) T.S.Ying	Podophyllaceae	Ulu-lu, Papri, Bankakri	Herb	Fruits edible.
27	<i>Prunus armeniaca</i> L.	Rosaceae	Chul, Chuli	Tree	Fruits eaten raw or as dry fruits. Dried fruits are also used for making local beverages called 'Chul Rak' or 'Chul Phasur' and local dishes 'Chul Phanting'.
28	<i>Prunus cerasoides</i> Buch.-Ham. ex D.Don	Rosaceae	Paja	Tree	Fruits edible.
29	<i>Prunus cornuta</i> (Wall. ex Royle) Steud.	Rosaceae	Krun, Jamu	Tree	do
30	<i>Prunus mira</i> Koehne	Roaceae	Reck, Rok, Behmi	Tree	Fruits eaten raw or as dry fruits. The dried fruits are also used for making local beverages called 'Reg Rak' or 'Reg Phasur'.
31	<i>Sorbus foliolosa</i> (Wall.) Spach	Rosaceae	Ranreg, Jungli seo	Tree	Fruits edible.
32	<i>Sorbus lanata</i> (D.Don) S.Schauer	Rosaceae	Banpatti, Bolu	Tree	do
33	<i>Pyrus pashia</i> Buch.-Ham. ex D.Don	Rosaceae	Shagal, Batangi, Kainth	Tree	do
34	<i>Pyrus pyrifolia</i> (Burm.f.) Nakai	Rosaceae	Bada kainth	Tree	do
35	<i>Ramaria abietina</i> (Pers) Quel.	Gomphaceae	Chayun	Fungi	Fruitification is cooked for making delicious vegetables.
36	<i>Ribes alpestre</i> Wall. ex Decne.	Grossulariaceae	Shutum	Shrub	Fruits edible.
37	<i>Ribes glaciale</i> Wall.	Grossulariaceae	Khali	Shrub	do
38	<i>Ribes griffithii</i> Hook. f. & Thomson	Grossulariaceae	Khali	Shrub	do
39	<i>Ribes himalense</i> Royle ex Decne.	Grossulariaceae	Khali	Shrub	do
40	<i>Ribes orientale</i> Desf.	Grossulariaceae	Jamey	Shrub	do
41	<i>Rosa macrophylla</i> Lindl.	Rosaceae	Kuja, Benyl	Shrub	do
42	<i>Rosa sericea</i> Wall. ex Lindl.	Rosaceae	Manger	Shrub	do
43	<i>Rosa webbiana</i> Wall. ex Royle	Rosaceae	Pashu, Sea, Mangel	Shrub	do
44	<i>Rubus biflorus</i> Buch.-Ham. ex Sm.	Rosaceae	Anchu	Shrub	do
45	<i>Rubus ellipticus</i> Sm.	Rosaceae	Kinsar, Kala, Cho- Sho	Shrub	do
46	<i>Rubus niveus</i> Thunb.	Rosaceae	Huftoo, Kala hinure	Shrub	do
47	<i>Rubus pedunculatus</i> D.Don	Rosaceae	Kalakha, Swating	Shrub	do
48	<i>Sparassis crispa</i> (Wulfen) Fr.	Sparassidaceae	Chyun, Cauliflower mushroom	Fungi	Fruitification is cooked for making delicious vegetables.
49	<i>Taxus wallichiana</i> Zucc.	Taxaceae	Nemdal, Barmi, Rakhal, Sangcha	Tree	Fruits edible.
50	<i>Viburnum cotinifolium</i> D. Don	Caprifoliaceae	Khom pang, Bhutool, Tustus, Taliana	Shrub	do

b. Seeds

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Aesculus indica</i> Colehr. ex Camb.	Hippocastanaceae	Jungli kharor	Tree	Seeds are grinded to make flour and mixed with barley flour and eaten by the local people.
2	<i>Amaranthus caudatus</i> L.	Amaranthaceae	Dankhar	Herb	Seeds are roasted on the hot pan and eaten.
3	<i>Bistorta affinis</i> (D.Don) Greene	Polygonaceae	Rammu	Herb	Seeds edible.
4	<i>Bunium persicum</i> (Boiss.) B. Fedtsch.	Apiaceae	Kalazira	Herb	Seeds used as spices and condiments.
5	<i>Carum carvi</i> L.	Apiaceae	Shia, Makoziira	Herb	do
6	<i>Castanea sativa</i> Mill.	Fagaceae	Mitha Khanor, Poo, Kapoo	Tree	Roasted seeds edible.
7	<i>Chenopodium album</i> L.	Chenopodiaceae	Bithu, Bathu, Neukhar	Herb	Seeds cooked with rice and eaten.
8	<i>Cicer microphyllum</i> Benth.	Fabaceae	Ner	Herb	Roasted seeds edible.
9	<i>Corylus colurna</i> L.	Betulaceae	Vilayati Poo, Ge Bija	Tree	Raw and roasted seeds edible.
10	<i>Corylus jacquemontii</i> Decne.	Betulaceae	Ge Bija	Tree	do

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11	<i>Eleusine coracana</i> (L.) Gaertn.	Poaceae	Kodha, Kodro	Herb	Seed flour used for making chapatis and other local dishes.
12	<i>Fagopyrum esculentum</i> Moench	Polygonaceae	Ogli, Ogla, Gamrus, Buckwheat	Herb	Seed flour is used for making local dishes called 'Hodh', 'Dhoo' or 'Bro' and 'Rang Khobra'.
13	<i>Fagopyrum tataricum</i> (L.) Gaertn.	Polygonaceae	Brus, Bra, Duckwheat	Herb	Seed flour is used for making local dishes called 'Hodh' and 'Dhoo' or 'Bro'.
14	<i>Hordeum vulgare</i> L.	Poaceae	Tak, Ta, Cha	Herb	Seed flour is used for making local dishes and beverages called 'Chwa Rak' or 'Chwa Phasur'. The grains also used in hawans, religious rites, marriages and funeral ceremonies.
15	<i>Impatiens edgeworthii</i> Hook.f.	Balsaminaceae	Tik, Yellow balsam	Herb	Raw seeds edible.
16	<i>Impatiens glandulifera</i> Royle.	Balsaminaceae	Tik, Himalayan balsam	Herb	do
17	<i>Impatiens sulcata</i> Wall.	Balsaminaceae	Tik	Herb	do
18	<i>Impatiens thomsoni</i> Hook.f.	Balsaminaceae	Tik	Herb	do
19	<i>Juglans regia</i> L.	Juglandaceae	Ka, Kach, Khor, Akhrot, Kath	Tree	Nuts edible. Oil extracted from the nuts is used for therapeutic purposes as well as vegetable oil.
20	<i>Pennisetum glaucum</i> (L.) R.Br.	Poaceae	Kawani	Herb	Grains cooked with rice to make local dishes.
21	<i>Pinus gerardiana</i> Wall. ex D.Don	Pinaceae	Neoz, Ree, Chilgoza	Tree	Nuts edible. Garlands made from seeds are offered to local deities, relatives during marriage and birthday celebrations.
22	<i>Prunus armeniaca</i> L.	Rosaceae	Chul, Chuli	Tree	Oil from the kernel is used as alternative of Desi ghee and therapeutic purposes. Kernels cooked with rice to make local dish called 'Remo Thukpa'. Garlands made from seeds are offered to local deities, relatives during marriage and birthday celebrations.
23	<i>Prunus mira</i> Koehne	Roaceae	Reck, Rok, Behmi	Tree	do

c. Leaves

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Allium caesium</i> Schrenk	Alliaceae	Dhum	Herb	Leaves are used for making chutney and as spices and condiments.
2	<i>Allium carolinianum</i> DC.	Alliaceae	Laevot	Herb	do
3	<i>Allium humile</i> Kunth	Alliaceae	Jungli lassan	Herb	do
4	<i>Allium jacquemontii</i> Kunth	Alliaceae	Jungli payaz	Herb	do
5	<i>Allium rubellum</i> M. Bieb.	Alliaceae	Jungli payaz	Herb	do
6	<i>Allium stracheyi</i> Baker.	Alliaceae	Farna	Herb	do
7	<i>Bergenia ciliata</i> (Haw.) Sternb.	Saxifragaceae	Patthartod, Pashanbeda	Herb	Leaves mixed with flour is used for making pakodas.
8	<i>Bergenia stracheyi</i> (Hook.f. & Thomson) Engl.	Saxifragaceae	Lapatrey, Lapatrang, Patthartod	Herb	Dried leaves used in preparation of local Namkeen/ salted tea.
9	<i>Cannabis sativa</i> L.	Cannabaceae	Bhang, Kus	Herb	Leaves used for making pakodas and also as hallucinating agent.
10	<i>Chenopodium album</i> L.	Chenopodiaceae	Bithu, Bathu, Neukhar	Herb	Leaves cooked as vegetable
11	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Lingad, Lingadu	Fern	Fronde are used for making vegetables and pickles.
12	<i>Fagopyrum acutatum</i> (Lehm.) Mansf. ex K.Hammer	Polygonaceae	Junglo Brus, Bra	Herb	Tender leaves cooked as vegetables.
13	<i>Fagopyrum esculentum</i> Moench	Polygonaceae	Ogli, Ogla, Gamrus, Buckwheat	Herb	Tender and dried leaves cooked as vegetables.
14	<i>Fagopyrum tataricum</i> (L.) Gaertn.	Polygonaceae	Brus, Bra, Duckwheat	Herb	do
15	<i>Girardinia diversifolia</i> (Link)	Urticaceae	Khorgya, Nupun	Herb	Tender leaves cooked as

	Friis				vegetables.
16	<i>Hippophae rhamnoides</i> L. subsp. <i>turkestanica</i> Rousi	Elaeagnaceae	Dhurchuk, Charma	Shrub	Dried leaves used for making local Namkeen/ salted tea.
17	<i>Hippophae salicifolia</i> D.Don	Elaeagnaceae	Surch, Surchu, Charma	Tree	do
18	<i>Hippophae tibetana</i> Schldt.	Elaeagnaceae	Surch, Surchu	Shrub	do
19	<i>Mentha arvensis</i> L.	Lamiaceae	Kala pudina	Herb	Leaves used as spices and condiments.
20	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	Jungli pudina	Herb	do
21	<i>Mentha spicata</i> L.	Lamiaceae	Baghicheo pudina	Herb	do
22	<i>Nasturtium officinale</i> R.Br.	Brassicaceae	Ti Kan, Bulti kanch	Herb	Leaves used as vegetables.
23	<i>Oxyria digyna</i> (L.) Hill	Polygonaceae	Shup-chu	Herb	Leaves eaten for quenching thirst and also making chutneys.
24	<i>Phytolacca acinosa</i> Roxb.	Phytolaccaceae	Jharka	Herb	Leaves used as vegetable.
25	<i>Rheum australe</i> D.Don	Polygonaceae	Archi, Chuchi, Kultho chi	Herb	Leaf petioles are eaten for quenching thirst and also used for making chutneys.
26	<i>Rheum moorcroftianum</i> Royle	Polygonaceae	Archi, Chuchi, Kultho chi	Herb	do
27	<i>Rheum webbianum</i> Royle	Polygonaceae	Archi, Chuchi, Kultho chi	Herb	do
28	<i>Saussurea simpsoniana</i> (Fielding & Gardner) Lipsch.	Asteraceae	Ucha	Herb	Dried leaves used for making local Namkeen/ salted tea.
29	<i>Taxus wallichiana</i> Zucc.	Taxaceae	Nemdal, Barmi, Rakhal, Sangcha	Tree	Needles fed to the livestock during scarcity of fodder in winter season.
30	<i>Thymus linearis</i> Benth.	Lamiaceae	Ban-ajwain	Herb	Leaves used for making chutneys and as spices.
31	<i>Urtica dioica</i> L.	Urticaceae	Nupun, Khorgya	Herb	Tender leaves used as vegetables.
32	<i>Urtica mairei</i> H. Lev.	Urticaceae	Bichu bhuti, Nupun, Khorgya	Herb	do
33	<i>Urtica parvifolia</i> Buch.-Ham. ex Wall.	Urticaceae	Bichu bhuti, Nupun, Khorgya	Herb	do

d. Flowers

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
	<i>Bauhinia variegata</i> L.	Caesalpiniaceae	Kachnar	Tree	Flower buds cooked as vegetables.
	<i>Equisetum arvense</i> L.	Equisetaceae	Puccu	Herb	Strobili edible.
	<i>Rhododendron anthopogon</i> D. Don	Ericaceae	Muti, Mutishang	Shrub	Flowers used in the preparation of local Namkeen/ salted tea.
	<i>Rhododendron arboreum</i> Sm.	Ericaceae	Brass, Parag	Tree	Flowers used for making juice and chutneys

e. Shoots

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Cannabis sativa</i> L.	Cannabaceae	Bhang, Kus	Herb	Tender shoots used for making pakodas and also as hallucinating agent.
2	<i>Heracleum pinnatum</i> C.B. Clarke	Apiaceae	Hung shuli	Herb	Tender shoots filled with curd and eaten.
3	<i>Persicaria alpina</i> (All.) H.Gross	Polygonaceae	Chuti	Herb	Tender shoots are eaten for quenching thirst.
4	<i>Polygonum molle</i> D. Don	Polygonaceae	Chuti	Herb	do

f. Bark

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Betula utilis</i> D.Don	Betulaceae	Shak bottong, Shak pang	Tree	Dried bark used in the preparation of local Namkeen/ salted tea
2	<i>Taxus wallichiana</i> Zucc.	Taxaceae	Nemdal, Barmi, Rakhal, Sangcha	Tree	do

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g. Tubers

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Arisaema jacquemontii</i> Blume	Araceae	Zamashang	Herb	Boiled tubers edible and is also used for making local beverages known as 'Zamashang Phasur'.
2	<i>Dioscorea deltoidea</i> Wall. ex Griseb.	Dioscoreaceae	Shingli-mingli	Herb	Tuberous roots used for making vegetable.

h. Bulbs

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Allium caesium</i> Schrenk	Alliaceae	Dhum	Herb	Bulbs used for making chutney and as spices and condiments.
2	<i>Allium carolinianum</i> DC.	Alliaceae	Laevot	Herb	do
3	<i>Allium humile</i> Kunth	Alliaceae	Jungli lassan	Herb	do
4	<i>Allium jacquemontii</i> Kunth	Alliaceae	Jungli payaz	Herb	do
5	<i>Allium rubellum</i> M. Bieb.	Alliaceae	Jungli payaz	Herb	do
6	<i>Allium stracheyi</i> Baker.	Alliaceae	Farna	Herb	do

i. Roots

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Angelica glauca</i> Edgew.	Apiaceae	Chora, Neuglang-supple	Herb	Root powder used as spice and condiments.
2	<i>Chaerophyllum reflexum</i> var. <i>acuminatum</i> (Lindl.) Hedge & Lamond	Apiaceae	Bull	Herb	Fresh as well as boiled roots edible.
3	<i>Chaerophyllum villosum</i> Wall. ex DC.	Apiaceae	Bull	Herb	do
4	<i>Thermopsis barbata</i> Benth.	Fabaceae	Prancha	Herb	Young rootstock used as vegetables.
5	<i>Bunium persicum</i> (Boiss.) B. Fedtsch.	Apiaceae	Kalazira	Herb	Tuberous roots edible.

j. Resin/ Gum

No	Botanical Name	Family	Vernacular Name	Habit	Mode of Usage
1	<i>Abies pindrow</i> (Royle ex D.Don) Royle	Pinaceae	Tosh, Pan	Tree	Resin exudates called 'Paan Chhi' chewed as bubble gum.
2	<i>Abies spectabilis</i> (D.Don) Mirb.	Pinaceae	Tosh, Pan	Tree	do
3	<i>Cedrus deodara</i> (Roxb. ex D.Don) G.Don	Pinaceae	Kialbung, Diar	Tree	Resin exudates called 'Kialbung Chhi' chewed as bubble gum.
4	<i>Picea smithiana</i> (Wall.) Boiss.	Pinaceae	Roy bottong, Roy pang	Tree	Resin exudates called 'Roy Chhi' chewed as bubble gum.
5	<i>Pinus wallichiana</i> A.B.Jacks.	Pinaceae	Lim bottong, Lim pang	Tree	Resin exudates called 'Lim Chhi' chewed as bubble gum.
6	<i>Salix alba</i> L.	Salicaceae	Shon	Tree	Gum exudates chewed for its sweetness.

Results and Discussion

In the present study 116 plant species belonging to 42 families distributed in 69 genera being used for edible purpose are described with recent botanical names, family name, vernacular names and mode of use (Table 1). Majority of plant species belong to phanerogams comprising 91 dicotyledons, 12 monocotyledons and 8 gymnosperms whereas cryptogams comprising 2 species of pteridophytes and 3 species belong to fungi. This includes 13 threatened species under different Red List categories of IUCN 2000 [25]. They are *Angelica glauca* Edgew., *Dioscorea deltoidea* Wall. ex Griseb. and *Rheum australe* D.Don (Endangered Globally); *Betula utilis* D.Don, *Ephedra Gerardiana* Wall. ex Stapf., *Sinopodophyllum hexandrum* (Royle) T.S. Ying and *Taxus wallichiana* Zucc. (Endangered); *Allium stracheyi* Baker. and *Rheum webbianum* Royle (Vulnerable Globally); *Bunium persicum* (Boiss.) B.Fedtsch., *Bergenia stracheyi* (Hook.f. & Thomson) Engl., *Hippophae rhamnoides* L. subsp. *turkstanica* Rousi and *Rhododendron anthopogon* D.Don (Vulnerable). *Capparis himalayensis*

Jafri, *Cicer microphyllum* Benth., *Corylus jacquemontii* Decne., *Heracleum pinnatum* C.B. Clarke, *Hippophae salicifolia* D. Don, *Impatiens edgeworthii* Hook.f., *Rheum moorcroftianum* Royle and *Rheum webbianum* Royle are endemic to western Himalayas - one of the mega endemic centres in India [26]. The most dominant families were Rosaceae (18 species), Polygonaceae (10 species), Apiaceae, Alliaceae and Pinaceae (each 6 species), Elaeagnaceae, Lamiaceae and Balsaminaceae (each 4 species), where as the remaining families having 1-3 species. The composition of edible plants under different categories of life forms indicates that out of 116 species; herbs (57 species) are predominant, followed by trees (32 species), shrubs (26 species) and one climber (Fig. 2).

From the survey, it was observed that the local inhabitants use the wild edible plants in raw or cooked form for maintaining their health, vitality and longevity. The different plant parts are consumed as a source of supplement of food, vegetables, spices, condiments, alcoholic beverages, according to their requirements and availability in nature (Fig. 3). Further, on the occasions of festivals, worships, weddings and other religious rituals special dishes and special drinks are traditionally prepared from the local plants based resources.

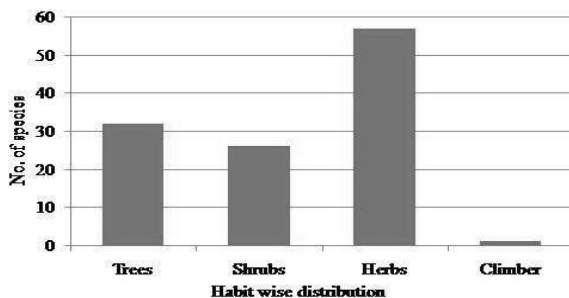


Fig. 2. Number of species and habit wise distribution

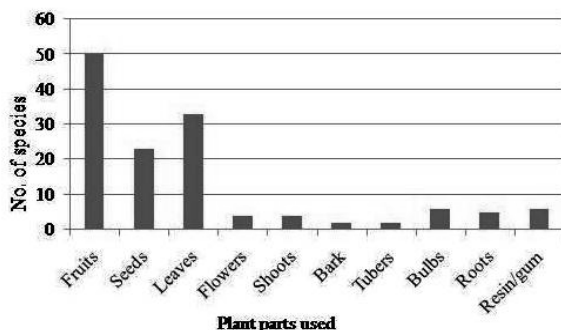


Fig. 3. Number of species and plant parts used as wild edible

The documented plants of some important wild edible species are shown in figure 4.

The diversity of food is a defining feature of Indian geography and culture. Indian food items vary from region to region, even some items it varies with in the region [27]. As far as the edibility is concerned, the most frequently utilized plant part species are fruits (50 species) followed by leaves (33 species) and seeds (23 species). The *Fagopyrum esculentum* (buckwheat) and *Fagopyrum tataricum* (duckwheat) constitutes the important staple food of people residing near the vicinity of forest areas. Seeds and leaves of 9 species are cooked with rice and also used as staple food by preparing chapattis. Further, seeds of 10 species are

consumed in roasted or pounded form by the local people. These plants not only provide inexpensive food but also serve as a potential source of alternative food.

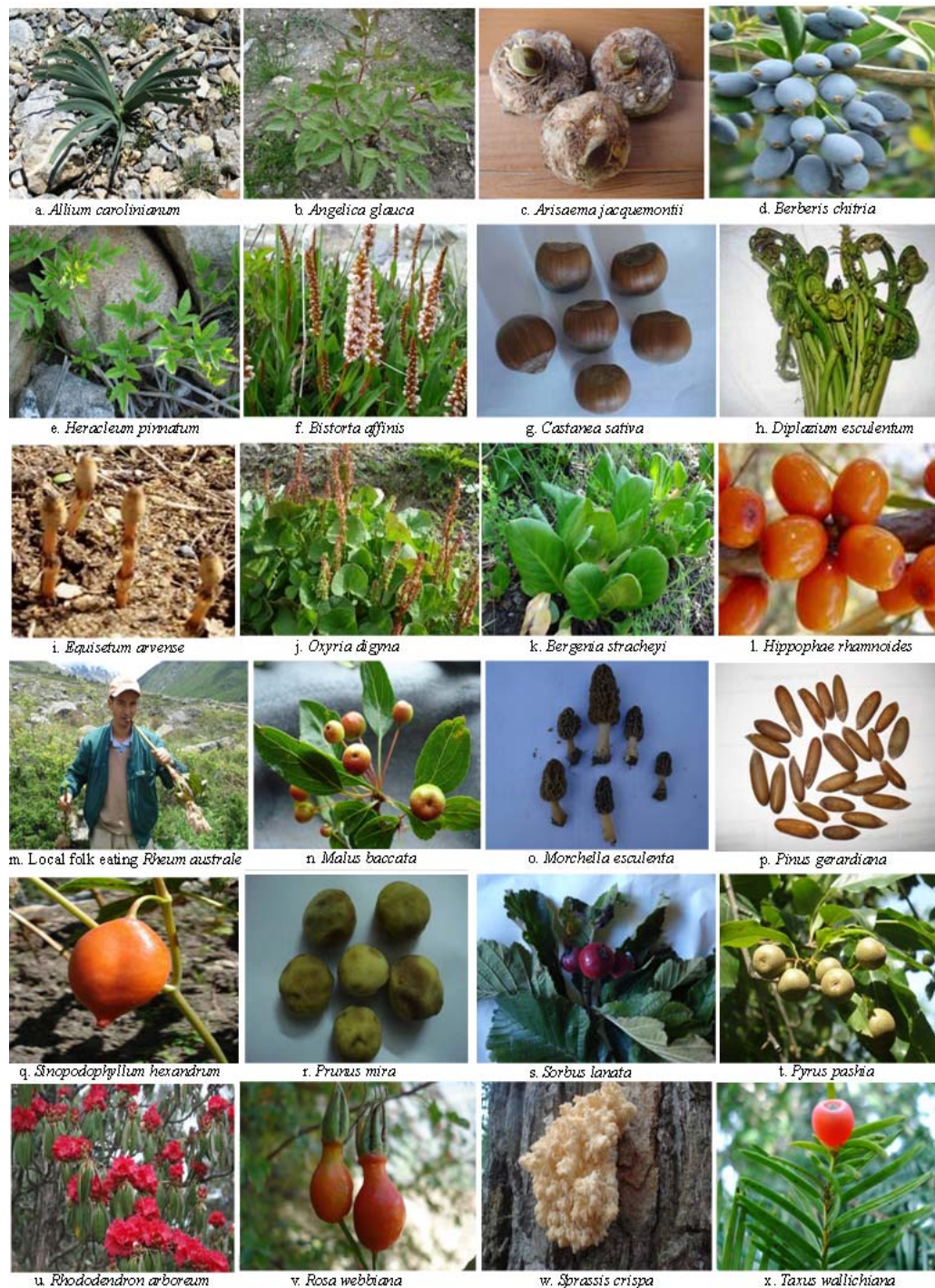


Fig. 4. Photographs of main wild edible species

Fruitification of *Morchella esculenta*, *Ramaria abietina* and *Sparassis crispa* are used for making delicious food. The ripened fruits of *Prunus armeniaca*, *Prunus mira*, tubers of *Arisaema jacquemontii* and seeds of *Hordeum vulgare* are used for making local beverages. The juice obtained from fruits of *Hippophae* (sea buckthorn) species are used for making curries. The edible oil extracted from kernels of *Juglans regia*, *Prunus armeniaca* and *Prunus mira* is used as an alternative of desi ghee and also as healing agents. Leaves and shoots of *Oxyria digyna*, *Polygonum alpinum*, *Polygonum molle*, 3 species of *Rheum* are eaten for quenching thirst. Barks of *Betula utilis* and *Taxus wallichiana*, leaves of *Bergenia ciliata*, *Saussurea simpsoniana* and flowers of *Rhododendron anthopogon* are used for preparing herbal tea.

Besides this, 12 species are used as flavoring agents in food products; 11 species are used in preparing chutneys. The underground bulbs of 6 species, roots of 5 species and tubers of 2 species are used as food plants. The flowers and shoots of 4 species and barks of 2 species are used in different ways. Resin and gums of 6 species are chewed as bubble gum during visits in the forest areas. Further, *Taxus wallichiana* needles are fed to the livestock during scarcity of fodder in winter season. Besides, people are offering the garlands made from seeds/kernels of *Pinus gerardiana*, *Prunus armeniaca* and *Prunus mira* to religious leaders, local deities and relatives during the custom of marriage and birthday celebrations.

Though, the apple is the main cash crop of the district, apricot, almonds, other dry fruits, Chilgoza nut and herbaceous medicinal plants fetches high prize in the markets that forms the backbone of their source of income. Chilgoza nut is the dominant wild edible which constitutes more than 90 percent of the total wild edibles and is also the main source of revenue for them.

These plants form an integral form of their food styles and this data is very helpful for the further studies in dietary diversification for augmenting food and nutrition security for ever increasing population of our country. It would also be necessary to undertake comparative study of plants and plant parts eaten by various tribals to bring out more useful information on the use of same plant by different tribal people [28]. Many of the wild food plants may not be freely available in future due to overexploitation, habitat destruction, land-slides and invasion of exotic plant species. Therefore, efforts are being done to bring some of these valuable plant resources under cultivation in order to maintain their natural population and gene pool in the wild. These measures will definitely contribute in continuous supply of wild edibles to the local people and other forest based communities and also helps in their conservation. Due to recent development activities in Kinnaur district of Himachal Pradesh, a drastic change in food styles and a decline in traditional knowledge among the local communities have been observed. Therefore, great efforts are required to document traditional knowledge among the local people so that these traditional knowledge can be preserved for the benefit of mankind in a holistic manner which will ultimately open new vistas in future plant research.

Conclusions

The issues related to food security and availability of healthy nutritious food is quite important for the human beings in the present scenario. The knowledge and consumption pattern of edible wild plants vary according to different localities and communities, as well as it reflects the history of local people, cultural significance and their traditions. It has been observed that native people of Kinnaur district of Himachal Pradesh are still dependent on natural plant resources for meeting their livelihood requirement. However, most of the wild edibles are consumed on seasonal basis depending upon their availability. These wild edible plant genetic resources not only help in changing the taste of local communities but they also provide additional nutritional supply for maintaining their vitality and sound health. Many wild food plants are also used by the local people for medicinal purposes in their day to day life. The connections between use of various plants and their conservation are also important ones, and it

was noted that the local inhabitants play a significant role in taking conservation measures so that loss of these valuable plant species in this region can be minimized. From the study, it is suggested that phytochemical analysis, pharmacological applications, antioxidant activities, biotechnological techniques and skill development training on farming practices for improving the yield are important feature perspective on wild edible plant genetics resources as well as for the discovery of new food resources. This will help in protecting the intellectual property of the tribal people by way of benefit sharing and sustainable utilization of wild genetics resources.

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