

Ethno-botanical Resources as Supplementary Foods and Less Known Wild Edible Fruits in District Rudraprayag, Uttarakhand, India

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ABSTRACT Surveys were conducted in entire Rudraprayag district of Garhwal, Uttarakhand, India in order to get information on traditional uses of plants by local inhabitants. A total of 700 plants were collected of which 282 species were found economically important as they are used by the people frequently for various purposes. A total of 20 species were used as supplementary food items for the preparation of traditional recipe or as an alternative during work far from the house and during the scarcity of primary food items. Similarly, 38 species are used as vegetables, many of which are commonly used and 48 wild species of edible or less known fruits. Besides other uses, species used as supplementary food, vegetables and fruits are only described here with traditional recipes.

INTRODUCTION

Ethnobotany is the study of the interrelations of primitive man and plants (Faulks 1958). It also deals with studies among the tribal and rural people for recording their unique knowledge about plant wealth and for search of new resources of herbal drugs, edible plants and other aspects of plants. However, it is no more confined to recording of plants used by primitive people. Ethnobotanical data are useful for discovering new plants resources, for fresh ideas to environment planners, a tool for basic selection of plant species for development of drugs by pharmacologists, phytochemists and clinicians, as a new source of history of plant names for linguists, a source for locating new germ-plasm for agriculturists, etc.

During last six decades, there has been wide resurgence of ethnobotany all over the globe (Jain 2000). Organized research in ethnobotany in India is also about six decades old. The work has been predominantly of documentation and inventorization, with varying degrees of details of usage (Jain 2010). Perhaps the outstanding example, at least in modern times, of the use of the literature is the huge compilation of all anti-tumour plants, cited in old texts and local folk medicine from all over the world for screening

purpose at Cancer Chemotherapy National Service Centre (CCNSC) (Hartwell 1967-1971). Atkinson (1882) published 12 volumes of the Gazetteer of North West Provinces of India, three of which are concerned with the Kumaon and Garhwal Himalayan region. Its first volume deals with ethnobiology, the second with economic botany and the last volume with the forest history, cultivation of tea, sericulture, etc. Singh and Arora (1978) pointed out that over 250 species of wild edibles occur in the Western Himalaya, the diversity being more pronounced in the Eastern Himalaya and north-eastern region, with over 300 species. These include root and tuberous types (37 species), green leafy types used as vegetables (121 species), providing edible flowers / buds (20 species), edible fruits (258 species). Similarly Farooquee et al. (2004) reported indigenous knowledge systems of high altitude society of Kumaun; Semwal et al. (2007) reported threat status of rare species of Kedar-nath Wild life sanctuary with economic uses; Phondani et al. (2010) recorded ethnobotanical uses of plants by Bhotiya tribal in Niti valley and Mehta et al. (2010) documented native plants and traditional foods of Uttarakhand Himalaya. Similarly, Dhyani et al. (2010) reported traditional uses as vegetable of some important medicinal plants from Uttarakhand.

Naithani (1984-85) made extensive exploration work in Chamoli district during 1976-1983 and published two volumes of 'Flora of Chamoli'

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li' enumerating 1934 species of which considerable part is contributed by a region now under Rudraprayag district. Similarly, Semwal and Gaur (1981) and Semwal and Gaur (1986) recorded alpine flora of Tungnath, an alpine region of Rudraprayag and alpine flora of Garhwal including major part of Rudraprayag district by Rawat (2003). However, little work carried out for plant collection in the district with respect to ethnobotanical knowledge after its inception, exceptions are work carried out by Semwal et al. (2007), Semwal and Saradhi (2008) and Semwal et al. (2010). Present work therefore, reports ethnobotanical knowledge of Rudraprayag district with main focus on supplementary food items, vegetables and wild fruits.

METHODS

a. The Study Area

The Rudraprayag district of Uttarakhand state of India lies between Latitudes 30°19'00" - 30°49'N and Longitudes 78°49'-79°21'13" E (Fig. 1) is a foremost destination for adventurous as well as religious tourism in Himalaya. The district is represented by altitudes between 800 - 8000 m above mean sea level with varied topography. The climate varies from subtropical monsoon type to tropical upland type. However, the northern and western parts of the district are perennially under snow cover with subalpine and alpine types of climate and having lofty Himalayan peaks, the notables are Kedar Dom (6260m) and Chuakhamba (7138m) with alpine ridges upto 3800m asl (Tungnath). Therefore, severe winter and comparatively higher rainfall are the characteristic features of the northern and western part. The average annual rainfall is around 1220.18mm while average annual rainfall is 1995mm in the district. The valley areas experienced hot summer with temperature upto 38°C while winters are very cold and temperature reached near freezing point and altitudes between 1200-2800 m experienced occasional snow fall. Altitudes beyond 3000m remained under thick layer of snow for 3-4 months of winter.

b. Ethnobotany

Preliminary survey for the collection of plants was conducted for the entire Rudraprayag district targeting different blocks and altitudes during the years 2007-2010. The collection of plants

was carried out throughout the year using herbarium press, blotters, newspapers and even polythene bags. The collection of plants was followed by processing, that is, pressing, sweating, drying, preserving and preparation of herbarium sheets according to the method suggested by Radford (1986). Dry specimens were poisoned by using Kew Mixture (115 gm HgCl₂ + 4.5 lit, Ethyl alcohol or spirit). Poisoned and dried specimens were mounted on the standard (42x28 cm) herbarium sheets adopting the usual herbarium techniques as suggested by Smith (1971). Plants were identified by using various floras including regional flora (Naithani 1984,1985; Gaur 1999) and has been compared with and verified from internationally indexed GUH Herbarium, Dept. of Botany, HNB Garhwal University, Srinagar and BSI, Northern circle Herbarium, Dehradun. The methods for the field work for ethnobotanical heritage were followed as suggested and used by Jain (1965), Jain and Dev (1964, 1966) and, Mitre (1991). For ethnobotanical analysis, methods of Jain (1967, 1986) and Jain and Rao (1977) were followed. Study was focused on collection and enumeration of species, ethnobotanical uses of the plants such as supplementary food, medicines, vegetables, wild fruits, fuel wood, fodder, timber wood, and agriculture tools. Before the initiation of in-depth ethnobotanical studies, substantial background information was also collected on the uses, distribution, and status of large groups of plant resources in the area through a baseline survey. This survey was conducted on a wide scale, involving all sections of the society of Rudraprayag district in Garhwal, Uttarakhand.

RESULTS

After extensive surveys conducted during 2007-2011 in Rudraprayag district of Garhwal Himalaya, a total of 700 species collected out of which 283 species were recorded as economically important species based on ethnobotanical knowledge exists in the district. Species were further categorized into different groups as described in Figure 2. However, species used as supplementary foods, vegetables and as an edible fruits are described in this paper.

a. Plants Used as Supplementary Foods

Ethnobotanical surveys of Rudraprayag district were carried out during 2007-2010. Under

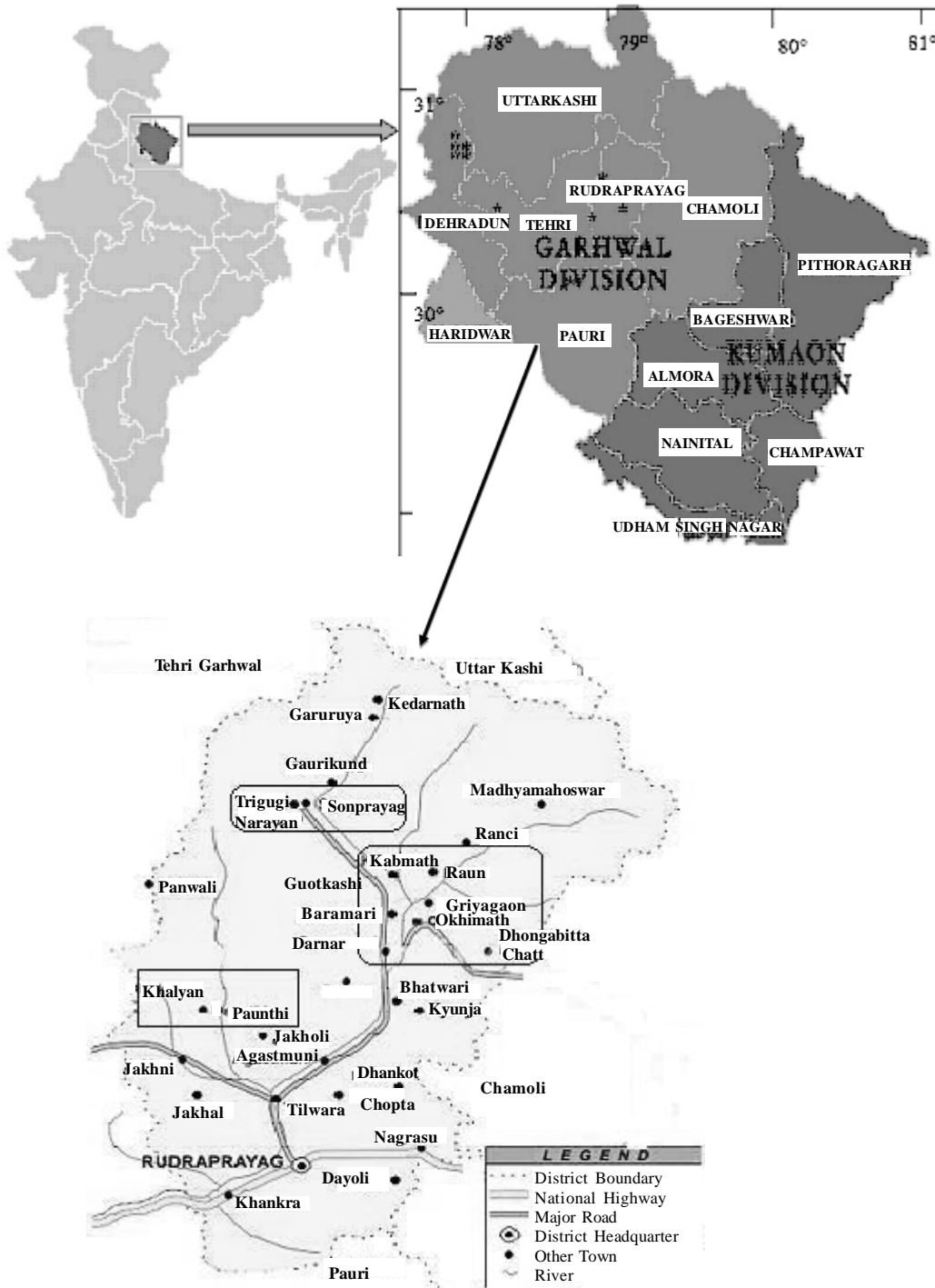


Fig. 1. Location map of the study area

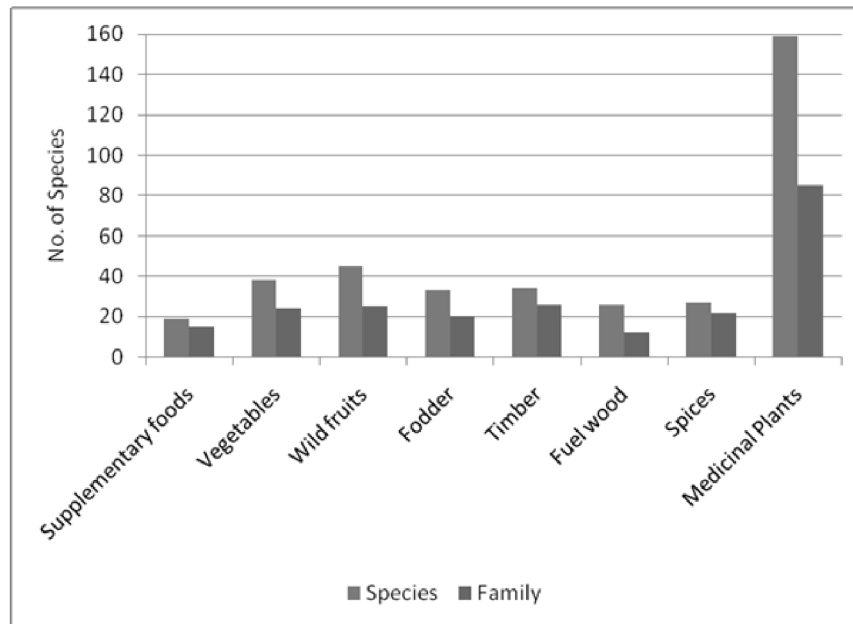


Fig. 2. Plant species documented as used for various purposes in Rudraprayag district

the category: supplementary foods, plants which are used during the adversity such as famine, time spent during stay away from home for collection of fuel and fodder especially women, time spent for livestock grazing in the forests and grazing land and while playing were considered which are used to satisfy thirst, hunger and avoid starving.

A total of 20 species representing 15 families were recorded under this category. Out of which, 4 crops viz., *Eleusine corocana* (L.) Gaertn., *Setaria italica* (L.), *Echinochloa frumentacea* Link. and *Sorghum nalepense* (L.) are major millet crops with *Amaranthus blitum* is also used as food grains on some occasions including food scarcity. Paddy is main agriculture crop of the district. Two traditional recipes, that is, *Chura* and *Chamchura* are also prepared from rice. Tubers / rhizomes of 4 species are used as a supplementary food during food scarcity, seeds of 2 species of *Fagopyrum* species are used as sacred food besides as a millets during the adversity, seeds/grains of other species of *Amaranthus* are also used as traditional food along as vegetables while leaves and flowers of other species are used as refreshment to fulfill thirst when water is not available while working and for traditional recipes of raw food at work site

without boiling / salad and as a juice/shakers. Some traditional uses such as making *Chpatis* and *Laddu* out of *Amaranthus* seeds are also described here which are now at the verge of mislay and therefore, needs to conserve. However, some value added items such as juice / shakers prepared from flowers of *Rhododendrons* are gaining popularity and taking a shape as a small scale industry in the region. Details regarding local names, part used and recipes of these species are presented in Table 1.

b. Plants Used as Vegetables

A total of 38 species mainly from wilds were recorded under this category. Some well known vegetables such as *Lagenaria vulgaris* Seringe. and *Cucurbita maxima* Duchesne are also considered since traditional recipe called "*Baddi*" is being prepared from these crops which are used as vegetables. Leaves and tendrils of 20 species are used as fresh green vegetables, succulent stems of 2 plants for making traditional vegetable called '*Baddi*', fruits /unripe fruits of 5 species, flowering buds of 4 species, rhizome and pods of 1 species each and fronds of two pteridophytes are also used commonly by local inhabitants in the district. More importantly, al-

Table 1: Enumeration of plants used as supplementary food, vegetable and edible fruits by inhabitants of Rudraprayag district

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
1.	<i>Aegle marmelos</i> (L.) Corr.	Rutaceae	<i>Bel</i>	Ripe fruits pulp is eaten raw.	Rare as fruit; common scared plant
2.	<i>Allium wallichii</i> Kunth.	Amaryllidaceae	<i>Duuna</i>	Fried young leaves are used as vegetables.	Rare
3.	<i>Aloe vera</i> Tourn. ex L.	Liliaceae	<i>Ghee-kunwar</i>	The thick succulent stem cut into pieces followed by addition of condiments and dried. Locally known as <i>Baddi</i> , used as vegetable during off season when vegetables are not available.	Traditional but rare now
4.	<i>Amaranthus blitum</i> L.	Amaranthaceae	<i>Chaulai</i>	Seeds are warmed on <i>Tawa</i> and eaten with honey during winter rain, fried seeds mixed with jiggery to form <i>Laddu</i> (sweets). <i>Chapatis</i> of grinded seeds during winter rains were very common in past. Boiled and fried leaves and tenders are used as green vegetables.	Occasionally as supplementary food; frequent as vegetable
5.	<i>Amaranthus spinosus</i> L.	Amaranthaceae	<i>Sagoti</i>	The leaves and tender shoots are boiled followed by frying and used as vegetable. Very rarely used now.	Frequent
6.	<i>Amaranthus viridis</i> L.	Amaranthaceae	<i>Ban Chaulai</i>	The leaves and tender shoots are boiled followed by frying and used as vegetable.	Frequent
7.	<i>Antidesma acidum</i> Retz.	Euphorbiaceae	<i>Emlī ?</i>	The sour and acidic leaves are eaten raw and boiled by local people.	Occasionally
8.	<i>Antidesma acidum</i> Retz.	Euphorbiaceae	<i>Emlī</i>	The acidic pulp of the fruits, not common tree of the area.	Occasionally
9.	<i>Asperagus adescences</i> Buch-Ham. ex Roxb.	Liliaceae	<i>Jhirni</i>	Young tendrils are burnt over fire and eaten raw; Tendril is also boiled into soup which is considered as very good tonic during recovery after long illness.	Occasionally
10.	<i>Bauhinia vahlii</i> Wt. Arn.	Caesalpiniaceae	<i>Malu</i>	Fried mature seeds.	Rare
11.	<i>Bauhinia variegate</i> L.	Caesalpiniaceae	<i>Kwiral</i>	The flowering buds are pickled or cooked as vegetable.	Occasionally
12.	<i>Berberis aristata</i> DC.	Berberidaceae	<i>Kingor</i>	Ripe black drupes.	Frequent during rainy season
13.	<i>Berberis lyceum</i> Royle.	Berberidaceae	<i>Kirmor</i>	Ripe blue black drupes	Rare during
14.	<i>Bombex ceiba</i> L.	Bombacaceae	<i>Semal</i>	The young flowering buds and fleshy calyx are cooked as vegetable.	Rare
15.	<i>Brassica juncea</i> (L.) Czern and Coss.	Brassicaceae	<i>Rai</i>	Leaves are cooked as vegetable	Frequent
16.	<i>Brassica napus</i> (L.) Hook. f. and Anderson.	Brassicaceae	<i>Lahiya</i>	Leaves are cooked as vegetable, seeds used for extracting edible oil, as a spice.	Frequent
17.	<i>Bridelia retusa</i> (Linn.) Spreng.	Euphorbiaceae	<i>Goli Govi</i>	Juicy pulp of the ripe drupes eaten as fruit.	Rare
18.	<i>Buchanania lanjun</i> Spreng.	Anacardiaceae	<i>Payal</i>	The dark brown ripe drupes eaten as fruit.	Rare

Table 1: Contd...

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
19.	<i>Callicarpa macrophylla</i> Vahl, Symb.	Verbenaceae	Dayya	A globule drupe is white, fleshy and sweetish and eaten as fruit.	Rare
20.	<i>Cannabis sativa</i> Linn.	Cannabinaceae	Bhangh	Dry seeds are fried and even eaten raw.	Rare, during winter only
21.	<i>Carissa opaca</i> Stapf ex Haines.	Apocynaceae	Karunda	The ripe purplish black fruits are eaten raw.	Common fruit
22.	<i>Cassia floribunda</i> Cav.	Caesalpiniaceae	Bara-chakunda	Young pods are cooked as vegetable.	Rare
23.	<i>Cassia tora</i> Linn.	Caesalpiniaceae	Chakund	Dried mature seeds are ground and as used like coffee powder or tea leaf for the preparation of herbal tea.	Rare
24.	<i>Celtis australis</i> L.	Ulmaceae	Kharik	Ripe yellowish red fruits are sweet in taste.	Rare
25.	<i>Chenopodium album</i> L.	Chenopodiaceae	Bethua	Young leaves and tendrils are boiled with water and condiments are added. Eaten as vegetable after frying.	Frequent
26.	<i>Colocasia esculanta</i> (L.) Schott and Endl.	Araceae	Pinalu	Leaves are boiled and fried along with <i>Atta</i> or <i>Baisen</i> paste formed a famous traditional recipe called ' <i>Gunala</i> '. Rhizomes are also used after boiling.	Frequent
27.	<i>Commelina benghalensis</i> L.	Commelinaceae	Kancha	Tender shoots are collected for vegetable purpose.	Rare
28.	<i>Cucurbita maxima</i> Duchesne.	Cucurbitaceae	Kaddu	Leaves and green fruits as green vegetables. Ripe fruits vegetable is prepared mainly during festivals and also offered to god. Local recipe called " <i>Kaphali</i> " - a combination of boiled leaves with wheat <i>atta</i> and spices and, " <i>Raitha</i> " a combination of curd and pulp of boiled ripen fruit with salt and spices as per taste are very common in the region.	Frequent
29.	<i>Curcuma angustifolia</i> Roxb.	Zingiberaceae	Ban-haldi.	Rhizomes are ground into flour after drying and consumed mostly as a famine food.	Rarely used
30.	<i>Debregeasia dichotoma</i> D.Don.	Urticaceae	Sinyaru	Ripe yellow globule fruits are sweet.	Rare
31.	<i>Debregeasia salicifolia</i> D.Don.	Urticaceae	Sinyaru	Orange yellow ripe fruits are sweet in taste.	Rare
32.	<i>Dendrocolamus hamiltonii</i> Nees ex Arn.	Poaceae	Bans	Boiled young shoots; as <i>Baddi</i> ; see <i>Aloe vera</i>	Rare
33.	<i>Dendrophthoe falcate</i> (L.f.)	Loranthaceae	Banda	Ripe fruits are eaten.	Rare
34.	<i>Dioscorea belophylla</i> Voight.	Dioscoreaceae	Tairu	It is wild species of temperate Himalaya with very slow growth. The fried boiled tubers are eaten during winter especially during festivals.	Occasionally during festivals
35.	<i>Dioscorea bulbifera</i> L.	Dioscoreaceae	Ganthi	The light brownish and yellow fleshy bulbs developed at shoot are cooked as vegetable. Tubers after mitigation were reported to eaten during famine.	Rare

Table 1: Contd...

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
36.	<i>Dioscorea deltoidea</i> Wall.	Dioscoreaceae	<i>Tairu</i>	It is wild species of North west Himalaya with very slender vines and slow growth. The fried boiled tubers are eaten during winter especially during festivals.	Now cultivated in kitchen garden
37.	<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	<i>Lingura</i>	Young fronds are collected; hairs are removed, boiled with salt and water until water is evaporated. They fried and eaten as vegetable. Now even available in vegetable markets during late summer to rainy season.	Frequent, now marketed as well
38.	<i>Diplazium spp.</i>	Athyriaceae	<i>Kuthara</i>	A rare fern found near streams and wet places at 1000-1500m asl. Young fronds are collected; hairs are removed, boiled with salt and water until water is evaporated. They fried and eaten as vegetable. Young flowers are sweet and eaten raw especially by children.	Rare, only elderly people can identify it
39.	<i>Diploknema butyraceae</i> Roxb	Sapotaceae	<i>Mayi</i>		Rare
40.	<i>Duchesnea indica</i> Andrews	Rosaceae	<i>Gandkaphal.</i>	Pinkish red juicy fruits are sweetish to sour.	Rare, by children
41.	<i>Echinochloa frumentacea</i> Link.	Poaceae	<i>Jhingora</i>	Grains are grounded and mixed with <i>Manua</i> or wheat. Very good feed for stalled cow and buffalo. Ingredient of traditional Cari and 'Pauloo' in the area.	Occasionally, however, now being sold in market for a traditional recipe <i>Kheer</i> "
42.	<i>Eleusine corocana</i> (L.) Gaertn	Poaceae	<i>Kodu, Manuwa</i>	Grains are grounded and used for ' <i>Chapati</i> '.	Common, widely used especially ' <i>Chapati</i> ' and ' <i>Badi</i> '
43.	<i>Euphorbia royleana</i> Boiss	Euphorbiaceae	<i>Surai</i>	Succulent shoots are cut into small pieces cleaned, dried and prepared " <i>Baddi</i> " used as vegetables also believed to cure asthma.	Rare
44.	<i>Fagopyrum tataricum</i> (L.)	Polygonaceae	<i>Phaphara</i>	Known as food of festival; mainly eaten during fast.	Occasionally
45.	<i>Fagopyrum esculentum</i> Moench	Polygonaceae	<i>Oogal</i>	Known as food of festival; mainly eaten during fast. Traditionally chapatti is prepared on auspicious occasions. Leaves are used as green vegetables.	Occasionally
46.	<i>Ficus auriculata</i> Lour	Moraceae	<i>Timla</i>	Ripe fruits are sweetish. Green unripe fruits used as vegetable.	Frequent as fruits, Occasionally as vegetable
47.	<i>Ficus hispida</i> L.F.	Moraceae	<i>Timla, Gular</i>	Ripe fruits are edible. Green fruit is also used as vegetable.	Occasionally
48.	<i>Ficus nerifolia</i> Smith in Rees	Moraceae	<i>Thailka</i>	Ripe <i>Hypanthodium</i> is sweet. Occasionally	<i>Bedu</i>
49.	<i>Ficus palmata</i> Forsk	Moraceae		The black ripe fruits. The unripe fruits are cooked as vegetable.	Frequently, find place in traditional songs

Table 1: Contd...

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
50.	<i>Ficus semicor data</i> Buch. –Ham	Moraceae	<i>Kheena</i>	The ripe fruits are eaten mostly by children.	Fruits eaten frequently
51.	<i>Ficus subincisa</i> Buch. – Ham	Moraceae	<i>Chanchara</i>	Ripe Hypanthodium is sweet. Rarely eaten by children	Occasionally
52.	<i>Fragaria nubicola</i> Lindley	Rosaceae	<i>Gankaphal</i>	Soft and delicious small fruits are eaten by children.	Occasionally
53.	<i>Grewia optiva</i> Drumm ex Burr.	Tiliaceae	<i>Bhimal</i>	Ripe fruits are sometime eaten.	Rare
54.	<i>Hippophae salicifolia</i> L. D.Don	Elaeagnaceae	<i>Chuk</i>	Orange red fruits are edible, <i>Satawa</i> of fruits is used against cold.	Frequent
55.	<i>Indigofera heterantha</i> Wallich ex Brandis	Papilionaceae	<i>Sakina</i>	The pink flowering buds are fried or cooked as vegetable.	Rare
56.	<i>Indigofera pulchella</i> Roxb	Papilionaceae	<i>Sakina</i>	The flowering buds are fried or cooked as vegetable.	Rare
57.	<i>Jugulans regia</i> L.	Juglandaceae	<i>Akhrot</i>	Endocarp of nut is edible.	Common wild fruit
58.	<i>Lagenaria vulgaris</i> Seringe.	Cucurbitaceae	<i>Lauki</i>	Besides common use as vegetable, traditionally fruits are cut into small pieces, grinded and converted into a past and formed bolus like shape and dried in the sun and stored, traditionally called “ <i>Baddi</i> ”. The <i>Baddi</i> is used as vegetable in winter when there is scarcity of vegetable. “ <i>Tomari</i> ” a dried hollow fruit is used traditionally for storing a seeds and even pulses.	Frequent
59.	<i>Lecanthus wallichii</i> Wedd.	Urticaceae	<i>Chaulu</i>	The young shoots and leaves are used for vegetable purpose.	Occasionally
60.	<i>Lectuca dissecta</i> D.Don.	Asteraceae	<i>Churiya</i>	The young tendrils and leaves are used for vegetable purpose.	Occasionally
61.	<i>Leea crispa</i> Linn.	Leeaceae	<i>Gwalphal</i>	Blue black ripe fruits are eaten.	Rare
62.	<i>Morus alba</i> Linn.	Moraceae	<i>Sahtute, Kempoo.</i>	Ripe catkins are sweet in taste. children	Frequently by children
63.	<i>Morus australis</i> Poir.	Moraceae	<i>Kempoo</i>	Ripe catkins are eaten.	Frequent
64.	<i>Myrica esculenta</i> Buch. – Ham	Myricaceae	<i>Kaphal</i>	Known as king of wild fruits, very common edible wild fruit during June even marketed now.	Very commonly, king of wild fruits
65.	<i>Nasturtium officinale</i> R.Br.	Brassicaceae	<i>Sussua</i>	Young shoots of this aquatic plant are cooked as vegetable.	Rare
66.	<i>Oryza sativa</i> Linn	Poaceae	<i>Satti, Dhan</i>	Besides most important food, seeds are soaked in water overnight, warmed and then converted into famous recipe using <i>Okhal</i> followed by removing the husk known as <i>Chura</i> . one of the traditional gifts given to relatives. Similalry, grains are soaked, followed by frying with ghee and some jiggery is added called <i>Chamchura</i> .	Very common in the rural areas

Table 1: Contd...

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
67.	<i>Oxalis corniculata</i> L.	Oxalidaceae	<i>Bilmoru</i>	The leaves are cooked and consumed as vegetable with sour taste.	Rare
68.	<i>Paeonia emodi</i> Wallich ex Royle.	Paeoniaceae	<i>Chandrian</i>	Green leaves and twigs are boiled, mitigated and cleaned before frying and eaten as vegetable.	Occasionally
69.	<i>Phoenix humilis</i> Royle.	Araceae	<i>Thakul</i>	The bark is removed of young stem and branches and the inner pith is eaten raw or after boiling.	Rare
70.	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	<i>Amla</i>	Yellowish mature fruits, which are rich in vitamin C are eaten and used for preparing jams, jellies and pickles.	Frequent, also as value added products
71.	<i>Pinus roxburghii</i> Sargent, Silva N.	Pinaceae	<i>Kulai</i>	The mature ovules (seeds) are eaten.	Occasionally
72.	<i>Portulaca oleracea</i> L.	Portulacaceae	<i>Luniya</i>	The leaves are cooked and consumed as vegetable having sour taste.	Rare
73.	<i>Prunus armeniaca</i>	Rosaceae	<i>Chullu</i>	Yellowish brown fruits.	Frequent, now not common
74.	<i>Pueraria tuberosa</i> Roxb.	Papilionaceae	<i>Siralu</i>	The large tuberous roots having a taste like liquorices are boiled and consumed.	Rare
75.	<i>Pyracantha crenulata</i> D. Don.	Rosaceae	<i>Ghingaru.</i>	Small apple like red ripe fruits are eaten.	Rare
76.	<i>Pyrus pashia</i> Buch-Ham.	Rosaceae	<i>Mehlu</i>	Ripe fruits are sweetish.	Rare
77.	<i>Pyrus persica</i> Buch-Ham.	Rosaceae	<i>Plum</i>	Reddish brown fruits	Frequently, now rare fruit
78.	<i>Reinwardtia indica</i> Dumort.	Linaceae	<i>Phionly</i>	The fresh yellow flowers are chewed by the children.	Rare
79.	<i>Rheum moorcroftianum</i> Royle	Polygonaceae	<i>Dolu</i>	Young leaves and tendrils are boiled especially by "Gaddi" and shepherd in alpine region. It imparts sour taste.	Rare
80.	<i>Rhododendron arboreum</i> Sm.	Ericaceae	<i>Burans</i>	Flowers are eaten as salad. Making juice and squash out of the flowers is shaping as a small scale industry in temperate parts as it is considered very good for cardiac ailments.	Frequently
81.	<i>Rhus parviflora</i> Roxb.	Anacardiaceae	<i>Dhaura</i>	Ripe orange fruits are eaten.	Rare
82.	<i>Rubus ellipticus</i> Smith.	Rosaceae	<i>Lal hisel</i>	Orange-yellow fruits during May-June are picked and eaten by children	Frequent
83.	<i>Rubus niveus</i> Thunb.	Rosaceae	<i>Kali-hisol</i>	Blue-black ripe fruits are delicious in taste and collected by children during early rainy season.	Frequent, most delicious among <i>Rubus</i>
84.	<i>Rubus paniculatus</i> Smith.	Rosaceae	<i>Kathula</i>	Black ripe fruits are edible. restricted to some specific habitats	Rare as
85.	<i>Rumex hastatus</i> D. Don.	Polygonaceae	<i>Almoru</i>	Fresh leaves are eaten as salad with lemon and a pinch of salt and spices and is a good source of vitamin C.	Rare
86.	<i>Schleichera oleosa</i> Lour.	Sapindaceae	<i>Kusum</i>	Unripe fruits are pickled and ripe fruits are eaten.	Rare

Table 1: Contd...

S.No.	Species	Family	Vernacular name	Parts used and recipes	Frequency of use
87.	<i>Setaria italic</i> (L.)	Poaceae	<i>Kauni</i>	Grains are cooked as a substitute of rice during food scarcity and as a substitute	Rarely used now
88.	<i>Silena conoides</i> L.	Caryophyllaceae	<i>Tomrya</i>	Shoots and leaves are cooked as vegetable.	Rare
89.	<i>Solanum nigrum</i> L.	Solanaceae	<i>Ghinway</i>	The ripe berries are eaten.	Frequently eaten in valley area
90.	<i>Sorghum halepense</i> (L.)	Poaceae	<i>Cheena</i>	Similar as <i>E.frumentacea</i>	Rare
91.	<i>Syzygium cumini</i> L.	Myrtaceae	<i>Jamun</i>	Dark ripe fruits are eaten.	Frequent
92.	<i>Terminalia bellirica</i> Roxb.	Combrataceae	<i>Behra</i>	Kernels are eaten.	Rare as fruit, mainly for health care
93.	<i>Trapa natans</i> L.	Trapaceae	<i>Singhara</i>	Fruits collected from fresh water lakes are cooked as vegetable.	Very rare due to unavailability of fresh water lake.
94.	<i>Triticum aestivum</i> L.	Poaceae	<i>Gaihu</i>	Immature kernel / seeds are fired and eaten with salt called 'Umi' also used as vegetable /Dal.	Main cereal crop
95.	<i>Urtica ardens</i> Link.	Urticaceae	<i>Kandali</i>	Young shoots with leaves are collected, boiled with water, fried and eaten as vegetable after adding spices as per tastes during winter months. It is one of the most traditionally used vegetable though very rare now.	Occasionally now, though traditional recipe
96.	<i>Woodfordia fruticosa</i> L.	Lythraceae	<i>Dhaura</i>	Flowers nectar is sucked mainly by woman and children.	Rare
97.	<i>Zizyphus mauritiana</i> Lam.	Rhamnaceae	<i>Ber</i>	The ripe fruits are eaten sometime, not common though	Commonly used fruit

most all species are used alone as vegetables except few where addition of potato, wheat flour and *Baisen* were recorded as a ingredient of recipes. Detail recipes are described in Table 1.

c. Plants as Edible Fruits

Edible fruits along with their vernacular name and fruit types are presented in Table 1. Ethnobotanical survey of Rudraprayag district reveals that fruits / seeds of 45 species from wild / of rare occurrence are used as edible fruits. *Myrica esculenta*, *Syzygium cumini* and *Zizyphus mauritiana* are most common edible fruits used in all parts of the district. *Phyllanthus emblica* is also used frequently, however mostly as a value added products such as squash and pickles etc. *Juglans regia* distributed between 800-2000m was also common followed by *Rubus* species and *Berberis*. Fruits of *Ficus* species and *Morus*

alba are preferred mostly by children. Other fruits are common in one or few villages based on their distribution and occurrence. Among the wild fruits, *Myrica esculenta* is now marketed and is with full of marketing potentials. Fruits of most of the species are edible with some nut; kernel and seeds are also used as edible fruits. Two fruits viz., *Pyrus persica* and *Prunus armenica* occurred rarely are other fruits though traditionally plantation crop but now very rare in the district may be due to poor marketing or no value addition is done so far for these fruits.

DISCUSSION

The immense richness of botanical resources with statistics worldwide showed that only a very small fraction of plant resources has yet been utilized by the human race. Even whatever little is known, is mainly about some of the high-

er plants (Schultes 1963). India is recognized as one of the four major mega biodiversity of Asia. Majority of its forests are in Himalayan region, which although covers only 18% of the geographical area of the country, but accounts for more than 50% of India's forest cover and 40% of species endemism. The climatic, topographic and soil diversity of this region has resulted into the occurrence of several valuable and economically important plants. In India more than 3000 wild plants are used as subsidiary food and vegetables by various communities (Anonymous 1994).

It is estimated that in India about 800 species are consumed as food plants, chiefly by the tribal inhabitants (Singh and Arora 1978). Furthermore, 250 species can be developed as a new source of food in the near future (Anonymous 1994). Over 170 species provide edible fruits and are consumed by the northeastern tribes. Mostly, it is the fleshy, sweet / sub-sweetish pulp of the fruit that is eaten raw and the tribes have screened the enormously rich flora of the seasonal rain-forest habitats and picked up edible types. Himalaya, one of the richest hot spots of biodiversity in the world, offers immense opportunities in various fields of biological domains and associated patterns of sustainable life support systems. Rich diversity occurs in Himalaya growing naturally under diverse environmental conditions that is, from dry deciduous forest of north west to rain forest of north east and extending up to the alpine meadows, though the region occupied only 15% of geographical area of the country, but about 30% of the endemic species of Indian subcontinent are found in this region.

The economic aspects of ethnobotany is of immense importance such as what role do the plants gathered by local inhabitants of the region play in their economic life?, if any plant products bartered or sold; and their quantification and also to indicate possibilities of value addition and entrepreneurship (Jain 2010).

The ethnobotanical surveys reveal that the people of the Rudraprayag district evolved the mechanism of utility of various resources based on its availability. Some of the major species of plants used by people of the district for their varied requirements have been classified under different categories. The variability in term of utilization of various categories was also observed as a species is used for medicinal pur-

pose by inhabitants of one villages /area, similar species was used as vegetable or for other purposes.

Eleusine corocana (L.) Gaertn., *Setaria italic* (L.), *Echinochloa frumentacea* Link., *Sorghum halepense* (L.) *Amaranthus blitum* are major food grains after rice and wheat on many occasions including food scarcity. Some traditional uses such as making *Chpatis* and *Laddu* out of *Amaranthus* seeds are now at the verge of mislay and therefore, needs to conserve and for this value addition of these in addition to commercialization is required. One such example is *Jhingora Khir* which is now available in some restaurants of Uttarakhand as a traditional dish of Uttarakhand. Species of *Fagopyrum* (*Kuttu Aata*) were earlier regarded as supplementary food. However, now in market as scared food and used during festivals all over north India.

Rawat et al. (2010) reported that the people of the Tones valley in Uttarakhand have good knowledge about the properties of various plants spread over 1000 – 4500 m and are known to derive their food requirements from a numbers of wild plants. *Paonia emodi*, *Asparagus adscendens*, *Amaranthus viridis*, *Commelina maculate*, *Diplazium esculentum* are the major wild vegetables. In addition, vegetables like *Brassica oleracea*, *Lycopersicon esculentum*, *Solenum tuberosum* are common to diet of these people (Rawat et al. 2010). All these plants are widely used as vegetables in district Rudraprayag. In addition, *Diplazium* spp (*Kuthara*) is also reported as vegetables and it was not reported earlier from Uttarakhand. Similarly, some traditional recipes viz., *Gunala* (from leaves of *Pinalu* and *Kadu*), *Badi*, *Raitha* and *Kaphali* are although common recipes in the district, however not documented in the earlier literatures. Similarly immature kernel of *Triticum aestivum* are used as *Umi* and is very delicious recipe which is used as Dal /vegetables is also documented. *Badi* is generally prepared for the period of scarcity of fresh vegetables especially winter as most of species used as vegetables are available only during May-November. Flowering buds of *Bauhinia variegata* are reported as vegetable in present study. Saikaia et al. (2010) also described that petals of *Bauhinia variegata* are used as vegetable in hill districts of Assam and in Arunachal reveals that people residing in hills have evolved more or less similar traditions.

Crops like *Fagopyrum tataricum*, *Amaranthus paniculatus*, *Triticum aestivum*, *Oryza sativa*, *Phaseolus vulgaris*, *Glycine max*, *Macrotyloma uniflorum*, *Phaseolus mungo* and *Pisum sativum* are common food items in Tones Valley as reported by Rawat et al. (2010). Similarly, Mehta et al. (2010) reported many food recipes in Uttarakhand prepared from these species. Species viz, *Phaseolus vulgaris*, *Glycine max*, *Macrotyloma uniflorum*, *Phaseolus mungo* and *Pisum sativum* as reported above are also very common crops used as pulses (*Dal*) in the district but, not included in this study as they are widely cultivated. Species of *Dioscorea* were used during famine in earlier past but now also used during festive occasions. Sarkar et al. 2010 reported similar uses of *Dioscorea* species by Magar community of Buxa Duar area of West Bengal during *Kirat* festival.

Earlier, Rawat et al. (2010) reported wild fruits such as *Hippophae rhamnoides*, *Fragaria nubicola* species of *Rubus* and *Duchesnea indica* as a common wild fruits to diet of people of Tones valley. *Hippophae* is widely used in Niti Valley as medicinal as the cake is used to cure severe cold and cough and throat infections and used as ingredients of *Chutney* (local jelly), pickle as reported by Dhyani et al. (2010). Similar uses of this plant were reported from Rudraprayag. However, use in veterinary medicines as reported by Dhyani et al. (2007, 2010) was not observed during present study. Fruits of *Myrica esculenta* are now gaining popularity in town because of delicious taste and are being sold by local inhabitants. Similarly fruits of *Berberis* and *Rubus* have immense potential for value added entrepreneurship.

CONCLUSION

In general, it reveals that the district is a repository of vast ethnobotanical knowledge and many plants are used on daily basis to fulfill basic demands. Categories of supplementary food, vegetables and wild fruits provide an opportunity for bioprospecting for the discovery of new nutritional elements/ compounds in future.

RECOMMENDATIONS

Some traditional recipes documented during the course of present study as a food, vegeta-

bles and other value added products of fruits needs to be conserved and at the same time, also needs value addition so that it can be used as an alternate / option in near future by local people of the region.

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