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Wild edibles and other useful plants from the Sikkim Himalaya, India

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Abstract. The present paper discusses various wild plants of potential use with a main emphasis on wild edible plants of the Sikkim Himalaya. Of the total 175 wild plants used for food, 64% were edible as fruits/seeds, 18% leafy vegetables and 10% flowers and flower buds. Other plants were used as medicines, fermented food and beverages, dyes, oil, and for household goods. Occurrence and distribution of some important taxa are presented. Lepchas, Bhutias, Nepalese and Limboos are main ethnic groups of Sikkim Himalayas which have their peculiar food habits and lifestyles, however, all these groups equally use various wild plants for different purposes. *Spondias axillaris, Machilus edulis, Baccaurea sapida, Eriolobus indica, Elaeocarpus sikkimensis, Bassia butyracea* and a variety of medicinal plants (*Aconitum heterophyllum, Nardostychys jatamansi, Picrorhiza scrophulariflora, Podophyllum hexandrum, Heracleum wallichii, Swertia chirata)* are exploited on commercial scale and thus threatened their regeneration in the natural habitats. The need for *ex situ* (popularising them in agroforestry systems) and *in situ* (in natural habitats) conservation of these plants in the light of recent exploitation is emphasised.

Key words: distribution, productivity, nutrients, marketing, regeneration, conservation

Introduction

These has been a growing interest world over to explore, search and collect germplasm of plants which could have economical viability in near future (Gaerther 1962, Singh and Arora 1978, Tanaka 1976, Rapoport *et al.* 1995). The listings of plants and animals of ethnobiological value are important for knowing and evaluating human-plant relationship to their environment (Alcorn 1981a,b, Bye 1979). During the course of human civilising nearly 3000 plant species have been used as food and about 150 species have ever been cultivated (N.R.C. 1982). Less than 10 plant species are meeting over 90% of the world food demand (Wilkes 1981). It is expected that still huge diversity of plants is to be explored for their utility. India is store house of 45,000 plant species, out of which 17,000 are flowering plants with 60% endemic flora in a variety of climatic conditions and landscapes (Chatterjee 1940). Himalayan regions are particularly rich in biodiversity due to varied geographical, physiographical, topographical, climatic and ecological zones within the region (Khoshoo 1992). A large number of plant species are used for food purpose by the tribal in the Himalaya (Badhwar and Fernandez 1964, Sarin 1967, Gaur 1977, Atal *et al.* 1980, Hajra and Chakroborty 1981, Pantgtey 1981, Pangey *et al.* 1982, Biswas and Bhuyan 1983, Manahar 1986, Negi 1988, Gangwar and Ramakrishnan 1989,1990, Raju and Krishna 1990, Haridasan *et al.* 1990, Sharma and Gupta 1994, Maikhuri *et al.* 1994, Negi and Gaur 1994). Number of plant species are being used to meet fuel, timber and other needs. Due to fast growth of population, and environmental and cultural changes, the economic development has accelerated during recent years that is posing threats to natural resources in the Himalaya. Use of wild edible plants is a complementary resource and has promising possibilities therefore researches must be continued on this area. And as there is a growing concern about human destruction of vegetation in the mountains, it is necessary to know various economically important species before they really become extinct.

Sikkim is a hill state and has very rich plant diversity as it is expected that over 6,000 plants harbor here (Shenga 1993). The state has subtropical to temperate and alpine type of climatic conditions in an elevation range from 300-8,500m above sea level. Low lands are utilised for double crop production but most of the high lands have monocroping system (Sundriyal *et al.* 1994). Besides growing the traditional crops, natives consume many wild plants and also use other plants for various purposes. Some of these wild plants also come to the market. These plants has got little attention despite of their various uses. The aim of this study is to give detailed information on various wild edible plants, their distribution, marketing and regeneration status in the Sikkim Himalaya. An Attempt has also been made to provide information on various other plants and products which have significant use value in the day to day life in the Sikkim

state. It is considered that by providing information on such local useful plant species, the official would enlighten to take them in the development programmes for the area, as well as it will help researchers to undertake in-depth research on these lesser known crops. Possibly a few plants could be exploited for large scale cultivation in near future and thus may help in meeting out the demand of food for growing population.

Study area and climate

Sikkim state falls in the eastern Himalayan zone of India (27˚4´46´´to 28˚7´48´´N and 88˚58´´to 88˚55´25´´E) and covers 7096 km^2 area (Fig.1). It is bounded by Nepal on the west, by Tibet on the North, by Bhutan on the east and Darjeeling district of west Bengal on the south. The state forms the entire upper catchment of the river Tista drainage system. The state is rich in cultural and biological diversity. The climate is typically monsoon with an average rainfall that varies from 1,200 mm (at 300 m elevation) to 4500 mm (at 2,000 m elevation), and over 60% of this rain comes during monsoon (i.e. June through September). The average maximum temperature varies from 21 to 35˚C and average minimum temperature 13 to 23˚C. Winter season, that extends from December through February is generally rain free and cold. The minimum temperature during this period varies from 0˚C at higher elevation to 9˚C in the valleys, while maximum temperature ranges between 13-28˚C. October-November is autumn period, while March-April is the spring season and both these seasons provide pleasant climatic conditions.

Lepchas, Bhutias, Nepalese and Limbus are main ethnic groups of Sikkim state and they differ from each other in their food habits, dresses and living styles. With growing a few agricultural crops people frequently collect wild edible plants for food and other plants for various purposes.

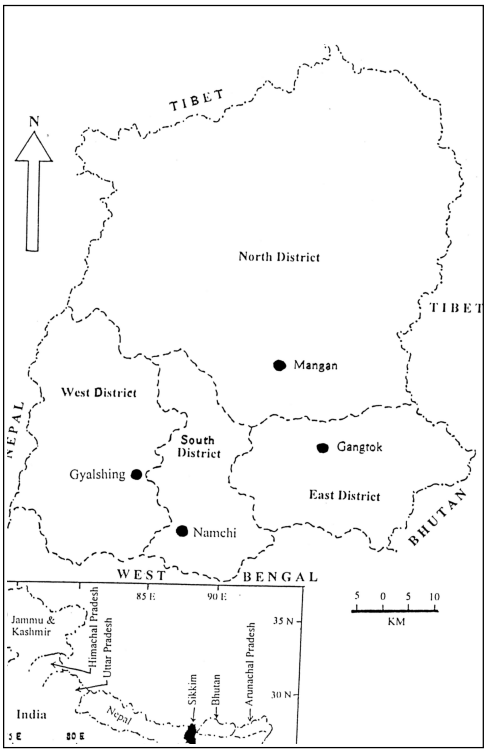

Fig. 1 Map of Sikkim and its location in the Himalayan range.

Materials and methods

The method employed in this study were designed with the purpose of providing baseline information on the use of plant species in local system, through literature survey and field visits to various areas from 1989-1995 in the Sikkim Himalaya. Extensive interviews were taken, and markets were surveyed regarding availability of wild plants. Plant samples were collected and identified with the help of specialists and revelant flora. Based on the specific micro climate, the Sikkim Himalaya is divided into 3 important zones, viz., low hills (up to 900 m elevation), mid hills (900-2,000 m) and upper hills (>2,000 m). A few species showed broader distribution, therefore zones like low-mid hills, mid-upper hills and low-upper hills were also categorised. Market survey was done at Gangtok (state capital) and Namchi (south district headquarters) by visiting weekly market "hat" and observations were recorded on the wild plants and their products available, number of retailer selling a particular species and quantity, and average price of the product.

Fruit productivity for a few selected tree species, which are most popular in the local markets, was done by harvesting method. Measurements on tree circumference at breast height (cbh), tree spread (canopy), number of branch/tree, number of fruit bearing branches/tree and number of fruits per branches were taken for number of individuals of each species. Fruits were harvested and per tree fruit production was estimated.

Samples of various wild edible species were brought to the laboratory and analysed for various nutrients following Allen *et al.* (1989), Rangana (1979), and Anderson and Ingram (1992). Seeds of some of the wild edible species were grown in the institutes nursery at Pangthang, and growth parameters are taken at every three months interval after germination.

Results and Discussion

In the Sikkim Himalayas a large number of wild plant species are used as food, medicine, beverages, fish-poisoning, dyes, oil, timber, firewood, fodder and various other purposes. Some important species under different categories are described below:

1. Wild Edible Plants

A total of 175 edible species have been recorded which are collected by locals from wild habitat, and they vary from 138 genera and 77 families. Out of 175 species, just 23% species have shown

annual or biannual nature rest species were perennial (Table 1 and Appendix I). Low hills possess most of the perennial species screened , 50% were annuals and remaining 50% were perennials. Higher number of wild edible species were recorded for low hills, followed by mid-

Distribution range	Perennial Total no. of plants	%	Annual-biannual Tot.no. of plants	%	Total
Low hill	43	25	2	1	45
Mid hill	39	22	10	6	49
Low-mid hill	27	15	9	5	36
Mid-upper hill	13	7	7	4	20
Upper hill	11	6	11	6	22
Low-upper hill	1	1	2	1	3

Low hill=300-900 m; Low-mid hill=300-1500 m; Mid hill= >900-2000 m; Mid-upper hill=1500-2500 m; Upper hill= >2000 m; Low to upper hills=300-2500 m

Table 1. Number of wild edible species and their life activity (percentage values are calculated with regard to the total number of plants).

hills and minimum at upper hills (Table 1). Majority of the wild edible plant species were trees, particularly at low and mid hills, followed by shrubs and herbs. The other life forms were woody-climber (Liana), woody-grass mainly bamboo and canes, tree-herbs (wild banana) and tree fern *(Cyathea),* climber, and epiphytic-parasitic plants (Fig. 2). Number of wild edible species under different plant life forms were 85 trees, 30 herbs, 29 shrubs, 13 woody climbers,

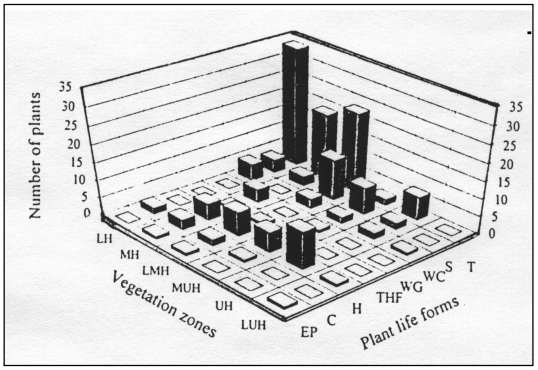

Fig. 2 Distribution of wild edible taxa belonging to different life forms (T=Tree, S=Shrub, H=Herbs, WC=Woody climber, THF=Tree-herb/fern, EP=epiphyte-parasite, WG=Woody-grass) at various vegetation zones (LH=Low hill, 300-900 m; LMH=Low-mid hill, 300-1,500 m; MH=Mid hill, >900-2,000 m; MUH= Mid-upper hill, 1,500-2,500 m; UH=Upper hill, >2,000 m; LUH=Low to upper hills, 300-2,500 m) in the Sikkim Himalaya.

8 climbers, 5 woody grasses, 3 epiphyte-parasites and 2 tree-herb/fern species (Fig. 2).

Agaricus species, locally known as "chayo", has at least 4 varietes/types which are yet to be identified, occur particularly during rainy season at all elevation in Sikkim and relished by the inhabitants. Similarly *Angiopteris evecta* a fern, occur from 500 m to 2,200 m. The rhizome of this species is ground in to flour and eaten. *Kadsura roxburghiana* is a large woody climber of low, mid and upper hill forests and its seeds are eaten all along the elevations.

Plants consumed are either in the form of fruit

Distribution range	Fruit/ seed	Flower/ fl.bud	Leaves shoot	Root rhizome	Others
Low hill	36	4	5	1	2
Mid hill	28	3	4	1	-
Low-mid hill	33	4	12	-	2
Mid-upper hill	11	3	6	-	2
Upper hill	10	3	5	4	2
Low-upper hill	1	1	2	2	-

Table 2. Plant distribution range and plant parts used of the wild edible species in the Sikkim Himalaya

seed, flower/flower buds, leaves and shoot, root or rhizome, pulp or pith (Table 2). They are eaten as raw (mainly fruits) or cooked as vegetables, flour, or beverage purposes. Consumption of fruits for most of the species at all elevation is most common, though number of plant species consumed for fruit decreased with elevation (Table 2). Among life forms for most trees and shrubs, fruits are eaten, whereas herbs are consumed for vegetable purpose as theileaves and shoot

Plant habit range	Fruit/ seed	Flower/	Leaves/ shoot	Root/ rhizome	Others
Tree	70	3	7	1	6
Shrub	2	3	2	4	-
Herbs	4	4	19	3	2
Woody climber	11	-	3	-	-
Climber	6	-	1	1	-
Tree-herb/fern	1	-	-	-	1
Parasite-epiphyte	-	2	1	-	-
Woody-grass	2	-	3	-	-

Table 3. Plant habit and plant parts used of various wild edible species in the Sikkim Himalaya.

parts are preferred (Table 3).

Table 4 reveals the consumption pattern of wild edible plants in Sikkim based on market survey. Species “frequently used” are collected in large quantities and sold into the market. “Commonly used” species are those plants which are collected from wild habitat and consumed at home in the villages. Species under "used but not so common" are consumed at their growing sites, while "rarely used" are those species which

Elevation	Frequent-ly used	Common used	*Occa-sional	Rarely u. used	Total
Low hill	13	10	8	14	45
Low mid hill	10	5	13	8	36
Mid hill	15	12	11	11	49
Mid upper hill	7	9	1	3	20
Upper hill	2	11	7	2	22
Low-upper hill	1	1	-	1	3
Total	48	48	40	39	105

*Occasional - used but not so common

Table 4. Consumption pattern of wild edible plants with elevation (based on market survey).

are edible but least used (Table 4).

People collect wild edible plants from natural habitats and some popular species are sold directly in the markets **(**Table 5). Fruits frequently used are *Spondias axillaris, Baccaurea sapida, Bassia butyracea, Machilus edulis, Calamus flagellum, Emblica officinalis, Castanopsis*

Plant habit Rarely	Preferably eaten	Commonly consumed	*Consumed consumed	
Tree	23	10	29	22
Shrub	3	11	7	8
Woody climber	1	7	2	3
Woody-grass	5	-	-	-
Tree-herb/fern	-	2	-	-
Herbs	10	15	2	3
Climber	3	3	-	2
Parasite/epiphyte	2	-	-	1

*Consumed but not common

Table 5. Plant life form and their utilization pattern (basen on village survey)

tribuloides, Eleagnus latifolia, Eriolobus indica, Juglans regia, Rhus semialata, Tamarindus indica, etc. and all of them remain available in the local markets at the time of their fruiting season. Species of bamboo like *Dendrocalamus hamiltonii, Arundinaria sp., Cephalostachyum capitatum* are relished by locals as vegetables and sold in large quantities in markets. Other common vegetables which are collected from wild and available in the market at different time each year are tender leaves of *Diplazium esculentum, Girardia palmata, Urtica sp., Chenopodium album, Nasturtium officinale,* root/tuber of *Dioscorea bulbifera* and fruiting body of *Agaricus sp*. Leaves of *Diplazium, Nasturtium officinale, Urtica dioica* and bamboo shoots are popular vegetable collected from wild habitats. All these species are equally consumed by rural as well as urban people, however, people in villages directly collect them from forest areas while urban people purchase them from local markets. It was also interesting to note that mainly species from low and mid hills are coming to the market, mainly because of well connection with towns. Wild plants at upper hills are mainly consumed at homes and thus not sold directly. However, people at much higher elevation collect medicinal plants from alpine areas and sell them to the market.

Leaves of *Camellia kissi* are used as a substitute for tea. Fruits of *Spondias axillaris, Rhus semialata, Zanthoxylum budrunga, Eriolobus indica, Heracleum wallichii, Emblica officinalis, Tamarindus indica* and *Mangifera sylvatica*, new buds of *Ficus benjamina* and new shoots of *Bambus nutans* are very popular for pickles and being used by all the tribes in the Sikkim state. A few wild plants which are preferred for chutney and also have medicinal value and are collected from low and mid hills and sold in the market, viz., *Bergenia ciliata, Terminalia belerica, Terminalia chebula, Evodia fraxinifolia, Swertia chirata, Viscum articulatum, Heracleum wallichii, Rhus semialata* etc.

A number of species are consumed at the time of lean period. Villages surveys revealed that each family generally takes 5-10 meals for a particular species, though most of the species are eaten just 2-3 times in a year. On an average each family uses at least 8-12 types of wild edible species (varieties) each year. The number of wild edible plants consumed each year is higher at low hills than upper hills, probably due to occurrence of large number of wild edible species at lower elevations. People at much higher elevations use various types of meats (dried or fresh) due to scarcity of vegetable though a few wild plants species are also consumed.

Lepchas have been the original tribe of Sikkim. They eat a large number of wild species as food. At higher elevation *Arisaema utile*, a cobra lily, is consumed by boiling the root bulb, dried and ground into flour. Fruits of *Entada scandens* are soaked and roasted to extract the poison and thereafter eaten, they are also used for washing hairs. Pith of a palm *Caryota urens* and *Cyathea brunoniana* is eaten by Lepchas. Similarly, in case of *Wallichia disticha,* pith near the summit of the tree is eaten, therefore such trees are cut and now-a days it is very difficult to find big individuals of such species. *Acer papilio*, a medium sized tree, yield sweet sap which is used as sugar. It seems that all these plants have been consumed as food in the time of scarcity, however, with the progress of human civilisation, people have developed a taste and now some of these dishes are supplied as delicacy.

Table 6 gives the data on seasonal availability or wild edible plants. At low and mid hills most of the plants are consumed during dry season. At upper hills maximum species are eaten during rains which can be attributed to better growing condition and just 3 species are taken during dry season. At higher elevation, winter season (Nov- Feb) is lean period when most of the plants cease their growth.

Elevation range	Season	Fruit	Flower	Leaves/ shoot	Rhoot/ rhizome	Others
Low	Dry	21	3	5	2	4
hills	Wet	8	-	2	1	-
	Ext	4	-	2	1	1
Low-mid	Dry	10	1	1	-	-
hills	Wet	2	1	2	-	-
	Ext	11	-	1	-	1
Mid	Dry	17	2	2	-	-
hills	Wet	9	1	1	-	-
	Ext	6	1	8	-	3
Mid-upper	Dry	3	-	3	-	-
hills	Wet	6	-	1	-	1
	Ext	3	-	1	-	1
Upper	Dry	1	-	1	-	1
hills	Wet	7	-	5	2	-
	Ext	1	-	1	-	1
Low-upper	Dry	-	-	-	-	-
hills	Wet	1	1	-	-	-
	Ext	-	-	-	1	-

Ext.-extended (covers wet and dry seasons)

Table 6. Seasonal availability of wild edible plant components at different elevations in the Sikkim Himalaya

Distribution of important taxa

Vertical distribution of the wild edible plants show that majority of the species grow in the sub-tropical zone up to 1500 m elevation. Number of wild edible species decrease with increase in elevation from sub-tropical (80) to temperate (55) and alpine (7) zones. It was also observed that arboreal habit of plants dominates at lower elevations whereas most of the wild edible plants for higher elevation are in herbaceous forms. Generally at lower elevations any

plant part (i. e. fruit, nut, leaves, pod, flower) of a species is utilised, whereas at higher elevation whole plant is consumed as food. Wild edible plants occurring in the Sikkim Himalaya show a varied range of distribution from endemic to the species of much wider distribution. Most of the wild edible species are commonly found all over Himalayas. *Malus sikkimensis, Erilobus indica, Wallichia disticha, Elaeocarpus sikkimensis, Machilus edulis, Sterculia roxburghii and Actinidia strigosa* show their dominance in the eastern Himalaya (Sikkim Himalaya) only. There are species which occur in Nepal and extends in distribution to Sikkim, Bhutan and Khasi hills *(Cycas pectinata, Mangifera sylvetica, Pandanus nepalensis, Pyrularia edulis, Agapetes serpens, Turpinia pomifera)*. Species of *Rubus, Berberis, Rhus, Juglans, Allium, Prunus, Pyrus, Rhododendron, Fragaria, Theropogon, Urtica, Schizandra* are distributed all over temperate Himalaya, Similarly *Bauhinia spp., Phlogacanthus, Shorea robusta, Bassia butyracea, Artocarpus lakoocha, Vitis equally* spread all over tropical Himalaya. Wild edible flora of Sikkim Himalayas also consist species distributed to tropical Asia up to Ceylon (viz. *Caryota urens, Leea macrophylla, Pentapanax*). There are species like *Syzygium claviflorum, Tupistra nutans, Castanopsis tribuloides, Castanopsis purpurella, Baccaurea sapida, Chasalia curviflora, Gynocardia odorata, Hodgsonii macrocarpa* whose distribution extend up to Assam, Burma and Java. A few elements have still wider distribution e.g. *Spondias axillaris* (throughout tropical Asia), *Celosia sp.* (tropical Asia, Africa, America) and *Nasturtium officinale* (Afghanistan, temperate Europe and Asia).

Rubus (21 spp.), *Litsaea* (13), *Grewia* (12), *Elaeocarpus* (12), *Machilus* (11), *Leea* (10), *Berberis* (10), *Cissus* (9), *Acer* (9), *Sorbus* (8) and *Bauhinia* (7) are important taxa having high diversity in Sikkim as well as in other parts of the Himalayas. *Spondias* and *Elaeagnus* have two species each while *Bassia, Eriolobus* and *Baccaurea* are represented by just one species in the Sikkim Himalaya.

Spondias axillaris is widely distributed in the tropical Himalaya particularly in the eastern sector. *Diploknema butyracea (Bassia butyracea)* is found in the sub-tropical Himalayas from Garhwal, Kumaun through Nepal (central Himalaya), Sikkim-Darjeeling, Bhuran to Arunachal Pradesh (eastern Himalaya). *Machilus edulis* is restricted to the eastern Himalaya and found growing abundantly in wild in Sikkim, Darjeeling, Meghalaya and Arunachal Pradesh. *Eriolobus indica* is distributed in the eastern Himalaya particularly in eastern Nepal, Sikkim, Darjeeling and Bhutan to Khasi hills. *Baccaurea sapida* is found growing in the base of the eastern Himalayas. All the above species are widely found in the Sikkim Himalaya and are sold in the weekly 'hats'.

Fruit productivity

Fruit productivity was measured for a few selected wild edible species. Per tree fruit productivity for *Spondias axillaris* vary from 2 kg per tree (cbh 90 cm, age< 8 years) to 200 kg per year (cbh 250 cm, age > 35 years), and for *Eriolobus indica* it varies from 6 kg per tree (cbh 62 cm) to 57 kg per tree (cbh 130 cm). In case of *Bassia butyracea,* fruits were harvested for a girth class size of 80 cm to 165 cm cbh size. *Bassia butyracea* is a tree of lower hill forest and grows up to an elevation of 1300 m above msl. Leaves of this species are very good fodder and therefore most of the trees are lopped for the purpose. High lopping of the tree sometimes reduced fruit productivity significantly. Fruits of *Machilus edulis* (local avocado) are rich in fat content. Fruit productivity per tree varies from 5 kg (cbh<135 cm) to 57 kg (cbh>300 cm).

2. Herbal Medicinal Plants

The tribal people use a large number of plant species as medicine (Table 7). Some of these plants are already exploited at large scale which has threatened their existence (Rai & Sharma 1994, Sharma et al. 1995). *Aconitum heterophyllum, Nardostachys jatamansi, Picrorhiza scrophularifera, Swertia chirata* are exported in large quantities and a few families from Lachung and Lachen areas of North Sikkim collect these species in bulk and sold to the commission agents in Gangtok, which send them out of the state. Other important species viz. *Heracleum wallichii, Terminalia belerica, T. chebula, Viscum articulatum* are consumed locally. A few people sell various herbal medicine in local market and known as "jaributy man" (herbal medicine practitioner). More than 20 plant species are sold by such persons. Due to poor socio-economic status of the people and strong tradition of using these plant medicines, rural folk collect and purchase these plants as per their need.

3. Fermented Foods and Beverages

Some plants are available in large quantities at the time of their production, a small quantity of such species is fermented and used at the time of lean period of vegetable availability (Table 8). Over the years these fermented foods have become an important part of local dishes and a wide variety of fermented products of cereals, pulses, soybeans, vegetables, flowers, milk, fish and meat etc. are available (Tamang *et al.* 1988). Nearly 90% population of Sikkim traditionally use fermented food items, which are kinema, gundruk, sinki, shel roti, mesu and churpi, whereas a local beer 'jnards' is consumed in day-to-day life (Table 8). Methods and ways of making these food products are already available as they are commonly used in Nepal, Bhutan and Darjeeling district of West Bengal (Batra and Millner 1976; Karki *et al.* 1983; Hesseltine 1979; Tamang *et al.* 1988).

4. Oil Yielding Plants

A variety of plants are oil yielding and their fruits/ seeds are eaten as raw or after fried. Fruits of

Plant species	Local name	Family	Plant part used & Uses
Aconitum heterophyllum (0549)	Bikh	Ranunculaceae	Used on fever, cholera,leprosy and rheumatism
Acorus calamus (0583)	Bojho	Araceae	Rhizone paste applied during fever
Artemisia vulgaris (0602)	Titeypatey	Astraceae	Leaves used to stop bleeding
Astible rivularis (0591)	Budho okhati	Rosaceae	Roots used in dysentery and diarrhea
Berginia ciliata (0510)	Pakhanbhed	Saxifragaceae	Dried rhizome in diarrhea and vomiting
Dichroa febrifuga (0657)	Basak	Hydrangeaceae	Leaves used in fever
Drymaria cordata (0643)	Abhijalo	Caryophyllaceae	Leaves and roots used in sinusitis and nasal blockade
Eupatorium canum (0611)	Banmara	Astraceae	Leaves used to stop bleeding
Heracleum wallichii (0516)	Chimphing	Apiaceae	Fruits in influenza
Holarrhena antidysentrica (0725)	Aulay Khirra	Apocynaceae	Roots used in chronic dysentry to stop bleeding
Litsaea citrata (0517)	Siltimur	Lauraceae	Fresh fruits
Mesua ferrea (0629)	Nagesuri	Guttiferae	Bark in skin diseases and menstrual disorders
Nardostachys jatamansi (0550)	Jatamansi	Valerianaceae	Root in hair loss
Picrorhiza scrophulariflora (0724)	Kutki	Scrophulariaceae	Roots in fever
Piper longum (0551)	Pipla	Piperaceae	Fruits use orally
Podophyllum hexandrum (0726)	Papri	Berberidaceae	Dried roots used as emetic, blood purifier, vermifuge, etc.
Rhus semialata (0539)	Bhakimlo	Anacardiaceae	Fruits in diarrhea and dysentery
Swertia chirata (0552)	Chirowto	Gentianaceae	Aboveground parts used in fever
Terminalia belerica (0568)	Barra	Combretaceae	Fruits
Terminalia chebula j(0568)	Harra	Combretaceae	Fruits in throat compication
Viscum articulatum (0544)	Harchoor	Loranthaceae	Plant paste in fractures

Table 7. Some wild medicinal plants used in Sikkim Himalayas

Food dish/ beverage	Species/material used (ver.name)	Family	Preperation
Food:			
Kinema	*Glycine max* (Soybean)	Leguminoseae	Seeds cooked and fermented
Gundruk	*Brassica campestris* (Rayo sag)	Cruciferae	Leaves dried and fermented
Sinki	*Raphanus sativus*(Root)	Cruciferae	Roots dried and fermented
Shel roti	*Oryza sativa* (Rice)	Poaceae	Rice powder is fermented and cooked in oil
Mesu	*Dendrocalamus hamiltonii* (Bamboo)	Poaceae	Shoots are fermented
Churpi	Milk product	-	Curdled milk boiled and wrapped in a cloth
Beverages:			
Jnards	*Elusine coracana* (Finger millet)	Poaceae	Grains cooked and fermented and extract is used
	Hordeum vulgare (Barlay)	Poaceae	The same as above
	Zea mays (Makai)	Poaceae	The same as above

Table 8. Some local fermented food dishes and beverages in Sikkim Himalaya

Plant species	Local name	Family	Plant part used
Abroma augusta (0658)	Sanu kapase	Sterculiaceae	Seed
Bassia butyracea (0504)	Chiuri	Sapotaceae	Seed
Citrullus colocynthis (0511)	Indrani	Cucurbitaceae	Seed
Elaeocarpus sikkimensis (0508)	Bhadrase	Elaeocarpaceae	Fruit/seed
Emblica officinalis (0513)	Amala	Euphorbiaceae	Fruit/seed
Garcinia odorata (0661)	Kaphal	Guttiferae	Seed
Gynocardia odorata (0653)	Gante	Flacourtiaceae	Seed
Hodgsonia macrocarpa (0606)	-	Cucurbitaceae	Seed
Litsaea citrata (0517)	Siltimur	Lauraceae	Seed
Shorea robusta (0659)	Sal	Dipterocarpaceae	Seed
Symploccos sp. (0664)	Kharane	Symplocaceae	Seed

Table 9. Some wild plants used for making oil or butter

Plant species	Local name	Family	Plant part used
Artemisia vulgaris(0602)	Titepati	Asteraceae	Aboveground parts
Albizia marginata (0665)	Kalo siris	Mimosaceae	Bark
Engelhardtia sp. (0660)	Mahuwa	Juglandaceae	Roots
Eupatorium odoratum (0611)	Banmara	Asteraceae	Whole plant
Gynocardia odorata (0737)	Gante	Flacoutiaceae	Fruits
Measa sp. (0586)	Bilaune	Myrsinaceae	Leaves

Table 10. Plant species used for fish-poisoning in Sikkim Himalaya

Plant species	Local name	Family	Plant part used
Juglans regia (0532)	Okhar	Juglandaceae	Bark
Mahonia sikkimensis (0577)	Chutrolkesri	Berberidaceae	Plant
Mallotus phillippensis (0728)	Sindure	Euphorbiaceae	Fruit
Rubia cordifolia (0662)	Majito	Rubiaceae	Plant
Rumex nepalensis (0576)	Halhale	Polygonaceae	Root
Shorea robusta (0659)	Sal	Dipterocarpaceae	Bark
Terminalia spp. (0568)	Bahera	Combretaceae	Fruit

Table 11. Some plant based dyes used in Sikkim Himalaya

Plant species	Local name	Family	CT	FW	C	F
Abies webbiana (0666)	Gobray salla	Pinaceae	+++	++	-	-
Ailanthus grandis(0693) Gokool	Simarubaceae	++	+++	+++	-	
Alnus nepalensis(0661)	Utish	Betulaceae	++	+++	+	-
Bauhinia purpurea(0584) Tanki	Caesalpiniaceae	-	-	-	++++	
Betula utilis (0647)	Bhojpatra	Betulaceae	+	+++	+	-
Castanopsis hystrix(0679) Jat katus	Fagaceae	+	++	++	+	
C. indica (0712)	Dhalne katus	Fagaceae	+++	+++	++	+
C. tribuloides (0581)	Masure katus	Fagaceae	++++	+++	++	+
Celtis tetrandra (0713)	Khari	Ulmaceae	-	++	-	++++
Duabanga drandiflora(0759)	Lampate	Sonneratiaceae	++	+++	+++	-
Engelhardtia spicata(0704)Mahuwa	Juglandaceae	++	+++	+++	-	
Ficus cunia(0704)	Khaniu	Moraceae	-	-	-	++++
F. hirta (0561)	Khasrey	Moraceae	-	-	-	+++
F. hookerii(0515)	Nebara	Moraceae	-	+	-	++++
F. nemoralis(0667)	Dudhilo	Moraceae	-	-	-	++++
F. roxburghii(0648)	Nebara	Moraceae	-	+	-	++++
Juglans regia(0532)	Okhar	Juglandaceae	++++	-	-	-
Litsaea polyantha(0699)	Kutmero	Lauraceae	-	-	-	++++
Macranga pustulata(0667)	Malata	Euphorbiaceae	+	++	+	+
Magnolia campbellii(0729)	Ghogechanp	Magnoliaceae	+++	+	-	-
Michelia excelsa(0663)	Ranichanp	Magnoliaceae	++++	-	-	-
M. lanuginosa(0678)	Phusrechanp	Magnoliaceae	+++	+	+	-
Quercus lamellosa(0730)	Book	Fagaceae	++	++++	++++	+
Q. fenestrata(0687)	Arkhaulo	Fagaceae	++	++++	++++	+
Q. spicata(0692)	Arkhaulo	Fagaceae	++	+	++	-
Rhododendron grande(0694)	Patleykurlingo	Ericaceae	++	+++	-	-
R. campanulatum(0710)	Kurlingo	Ericaceae	+++	++	-	-
Saurauia napaulensis(605)	Gugun	Sarauiaceae	-	+	-	++++
Schima wallichii(0649)	Chilaune	Theaceae	++	+++	++	+
Shorea robusta(0659)	Sal	Dipterocarpaceae	++++	++	++	-
Symingtonia populnea(686)	Pipli	Hamamelidaceae	++	+++	+++	++
Symplocos theifolia(0664)Kharane	Theaceae	+	++	++	-	
Terminalia myriocarpa(711)	Panisaj	Combretaceae	++	+++	+++	-
T. tomentosa(0668)	Pakhasaj	Combretaceae	++	+++	+++	-
Toona ciliata(0650)	Tuni	Meliaceae	++++	++	++	+

+Fairly used; ++Moderately used; +++Extensively used; ++++Best quality; -Not used

Table 12. Some important tree species use as constructional timber (CT), firewood (FT), Charcoal (C) and fodder (F) in Sikkim Himalaya

Citrullus colocynthis, a climber, are being collected in large quantities as its seeds provide oil. The seeds were sold @ US $ 1.5-2.5 per kg in 1994-95. Oil of *Gynocardia odorata* and *Pyrularia edulis* was used to light the lamps in old times. However use of these species has reduced remarkably during recent years due to easy availability of oil products from outside.

5.Plants for fish-poisoning and local dyes

Rural people still use a wide variety of plants to catch fishes (Table 10). The freshly crushed or powered plant component is put into the running streams and the quantity of plant material applied vary from species to species. It is reported that plant chemicals affect the respiratory system of fishes (Lama 1970), however, there is no report available on the effect of such poisoning on flesh quality of fish.

Some plants are used for making dyes (Table 11). A few dyes are used by local handicraft industries to colour the carpets and carvings. Colour of such dyes are lasting. *Rubia cordifolia, Mahonia sikkimensis* and *Juglans regi*produce good quality dyes.

6.Plants for timber, fodder and other miscellaneous purposes

People of Sikkim use various trees as construction timber and *Michelia excelsa, M. lnuginosa, Juglans regia, Toona ciliata, Abies webbiana* are popular timber species (Table 12). Each household needs 3-6 m^3 timber at the time of house construction. Poor people use bamboos for house construction. Villagers consume significant quantity of firewood (4,000 – 5,800kg/family/year).Average fodder need per family varies from 6,500-8,000 kg per year and about 30% of this fodder comes from agricultural fields, from agroforestry trees and agriculture by-products. A wide variety of species are also used for making agricultural implements (Sundriyal and Sharma 1996). In the process of timber, fuel and fodder collection forests are being encroached in almost all areas in the state.

Wood of *Boehmeria regulosa, Gmelina arborea* are being used for making wooden utensils and some carpenters are specialised in this artefact. Bhutias use *Pyrularia edulis* for butter-making implements and wooden carvings. Bamboos are used in various household courses (Table 13). Seeds of *Elaeocarpus sphericus* have religious value and their necklaces are priced items. Bark of *Edgeworthia gardneri* and *Daphne cannabina* are used as ropes for carrying back loads by local people. These two species are also used for making local paper.

Nutrient status of wild edible plants

Records on fruit length/width, fresh weight: dry weight ratio, number of seed per fruit, seed weight, fruit moisture content was highest in *Elaeagnus* and lowest in *Spondias*. Seed weight per fruit was highest for *Machilus edulis* and lowest in *Eriolobus indica*. The unit fruit weight on fresh weight basis was highest for *Eriolobus indica* (15.15 g) followed by *Machilus edulis* (11.02 g), *Spondias axillaris* (9.21 g), *Elaeocarpus sikkimensis* (6.75 g), *Elaeagnus latifolia* (5.80 g) and *Bassia butyracea* (5.38 g).

The ash content of was highest in the fruits of *Elaeocarpus sikkimensis* (4.0%) followed by *Bassia butyracea* (3.6%), *Elaeagnus latifolia* (3.3%), *Spondias axillaris* (2.9%) and *Machilus edulis* (2.5%). Fruits of *Elaeocarpus sikkimensis* showed highest acidity (3.75%), followed by *Passiflora sp.* (2.4%), *Baccurea sapida* (2.26%), *Bassia butyracea* (2.24%) and *Eriolobus indica* (2.23%). The total soluble salts (TSS) was highest in *Bassia* (15.2%), closely followed by *Elaeocarpus* (15%), *Passiflora* (14.4%), *Eriolobus* (14%), *Baccaurea* (12.5%), *Spondias axillaris* (8.6%) and minimum in *Elaeagnus latifolia* (5%). Total sugar content was recorded highest in the fruits of *Bassia* (7.9%), closely followed by *Baccaurea* (7.5%) and *Elaeocarpus* (6.9%). Sugar was relatively less in the fruits of *Passiflora* (3.5%) and *Eriolobus* (2.85%) and minimum in *Spondias* (0.24). Nitrogen was highest in the fruits of *Elaeagnus* (1.25%), followed by *Cucumis melo* (1.1%), *Zanthoxylum sp.* (0.89%), *Elaeocarpus* (0.86%), *Passiflora* (0.79%), *Machilus* (0.73%), *Bassia* (0.50%), *Baccaurea sapida* (0.46%), *Spondias* (0.35%) and *Eriolobus* (0.28%). The phosphorus concetration was higher in the fruits of *Machilus* (0.19%), *Spondias* (0.156%), *Zanthoxylum* (0.146%), *Baccaurea* (0.132%), *Eriolobus* (0.118%), *Cucumis* (0.115%), *Elaeagnus* (0.095%), *Bassia* (0.095%), *Passiflora* (0.090%) and least in *Elaeocarpus* (0.068%). Seeds of these plants are grown in the nursery and harvested at 3 months interval to know their growth parameters and chemical composition. In six-month old seedling, the leaf nitrogen was highest in *Eleagnus latifolia* (2.43%), followed by *Machilus edulis* (1.86%), *Bassia butyracea* (1.18%) and *Eriolobus indica* (1.62%). *Elaeagnus latifolia* has Frankia symbiosis and high nitrogen content is attributed to atmospheric fixation, therefore this species can be planted in degraded habitats. The phosphorus in the leaves of 6 selected species was higher in *Elaeagnus* (0.806%) and it was followed by *Eriolobus indica* (0.142%) and *Bassia butyracea* (0.065%).

Nitrogen content in the stem of 6 month old seedlings was estimated highest for *Bassia butyracea* (0.74%), followed by *Eriolobus indica* (0.142%) and *Machilus edulis* (0.38%). The phosphorus was estimated highest in *Machilus edulis* (0.079%) than in *Bassia butyracea* (0.058%).

Root parts of all seedlings of 6 selected species were also analysed for their chemical composition. *Machilus edulis* had highest nitrogen concentration (0.736%) in its roots of six month old seedlings than the *Bassia butyracea* (0.506%) and *Eriolobus indica* (0.46%). The phosphorus concentration was recorded maximum in the roots of *Eriolobus indica* (0.074%) and it was followed by *Bassia butyracea* (0.052%) and *Machilus edulis* (0.061%).

Natural regeneration and seed germination

Natural regeneration of most of the wild edible species and other plants is threatened particu-

Plant species	Local name	Family	Uses
Amomum subulatum (0644)	Elainchi	Gingiberaceae	Spice and cash crop
Arundinaria intermedia (0625)	Mallingo	Poaceae	Stem as straw for local drink
Bambusa nutans (0731)	Mala bans	Poaceae	Container for local drinks
Boehmeria regulosa (0732)	Daar	Urticaceae	Wooden utensils
Cephalostachiyum capitatum (0512)	Pareng	Poaceae	Basket (dokko) and house roofs
Dendrocalamus hamiltonii (0528)	Choya bans	Poaceae	Bamboo basket (dokko), mat (mandra) and ropes (chola)
Cinnamomum tamala (0641)	Tejpat	Lauraceae	Leaves as spice
Daphne cannabiana (0789)	Daphne/Argeli	Thymeleaceae	Bark for making papers
Dysoxylum sp. (0651)	Lahsune	Meliaceae	Wood containers
Edgeworthia gardneri (0656)	Argeli	Thymeleaceae	Bark used for ropes and paper making
Elaeocarpus sphericus (0645)	Rudrakshe	Elaeocarpaceae	Seeds used for neckless
Entada sp. (0595)	Pangra	Mimosaceae	Seeds used in washing hair
Gmelina arborea (0733)	Khameri	Verbenaceae	Wooded utensils
Juniperus sp. (0734)	Dhup	Cupressaceae	Leaves/twigs burn for insence
Pyrularia edulis (0640)	Amphi	Santalaceae	Wood use for artisans and implements
Thysanolaena maxima (0735)	Amliso	Poaceae	Broom
Zanthoxylum sp. (0526)	Timur	Rutaceae	Fruit as spice

Table 13. Wild plants of miscellaneous in Sikkim Himalaya

larly for those species which are collected in large scale. Regeneration of tree species is most threatened as people collect even the last fruit from the wild habitats. A study on the Mamlay watershed in south Sikkim has revealed that the *Spondias axillaris* has just 13 seedlings/ha. *Litsaea citrata* (6 seedlings/ha), *Elaeocarpus sikkimensis* (6 seedlings/ha), *Myrica sp.* (6 seedlings/ha), *Machilus edulis* (3 seedlings/ha), *Prunus cerasoides* (3 seedlings/ha) had very poor regeneration. Natural regeneration was relatively good for *Castanopsis tribuloides* (111 seedlings/ha), *Cinnamomum tamala* (66 seedlings/ha) and *C. impressinervium* (38 seedlings/ha), probably due to wide spread distribution of these species (Sundriyal and Sharma 1996).

Seeds of some selected wild edible species are raised in the nursery and *Machilus edulis* showed 100% germination after 2 months of seed sowing. *Elaegnus latifolia* had 60% germinated after one month of seed sowing, while seeds of *Bassia* had a germination of 82%. Germination period was relatively longer for seeds of *Elaeocarpus sikkimensis* (12 – 15 months), proably due to hard seed coat and 80% seeds were germinated.

Marketing status of wild edibles

Observations are being taken two important local markets (Hats) at Namchi and Gangtok to know the availability, market price and consumption pattern of wild edible species (Table 14). Weekly survey revealed the simultaneous availability of an individual species in the two markets, however, market prices varied at both the markets. Generally Gangtok market had higher prices of each species which is due to higher labour cost as well as involvement by middle men. Most of the items are present at higher quantity in Gangtok for each species which reflects bigger market at Gangtok. Wild plants are collected by locals from the forest areas and either directly sold by them or handed over to some commission agents.

Hajra and Chakraborty (1981) has reported a number of wild plants available in Lal market at Gangtok. Interview with shop owners revealed that though most of the species are still coming to the market, however, in recent years the quantity has decreased drastically. Also, species, like *Dioscorea sp., Elaeocarpus lanceaefolius, Juglans regia, Machilus edulis, Rhus semialata* were used to come to the market in large quantities before 10-15 years. The prices of each species has gone very high. For example market price for the fruits of *Elaeagnus latifolia* was recorded Rs. 10 per kg, 5 times more, in 1996 than in 1981. Similarly prices of bamboo shoots has risen by four folds, tender leaves/shoot of *Ficus* (kabra) by 3-5 times, *Diplanzium* by 4-6 times, *Zanthoxylum* by about 8 times, *Urtica* by 4-6 times, nuts of *Juglans* by 2 times *Machilus edulis* by 4 times and twigs of *Juniperous sp.* by 5 times in the year 1994/95 in comparison to 1981.

Conservation status of wild edible plant

Collection of large quantities of these wild edible plants from natural habitat has seriously affected their survival. Fruit collection of a number of wild tree species has checked their regeneration in nature. Considering the seriousness of the situation, Department of Forest, Govt. Of Sikkim has warned people to collect *Heracleum wallichii, Swertia chirata* and a few other species. Forest Department has started plantation of a large number of medicinal plants. Similarly, Department of Agriculture has started plantation of *Swertia chirata* under NWDP (National Wasteland Development Programme) project. However, wild edible species are yet to get a place in such plantation schemes.

Some ethnic groups have their own way to collect and conserve these wild edible species

Plant species	Local name	Time of availability	Namchi		Gangtok	
			No. of retailers	Market price (Rs)	No. of retailers	Market price (Rs)
Agaricus sp.	Chayo	Jun-Sep	6	10-20*	8	15-25*
Bassia butyracea	Chiuri	May	6	3-5*	5	5-8*
Castanopsis tribuloides	Katus	Nov-dec	7	40*	4	40-60*
Cinamonum sp.	Sinkauli	Whole year	10	30*	11	40*
Dendrocalamus hamiltonii	Tamba	Jun-Oct	4	12*	6	15*
Dioscorea sp.	Bantarul	Jan-Mar	5	5*	6	10*
Diplanzium sp.	Ningro	Mar-Aug	10	10-15*	13	15-20*
Elaeocarpus sikkimensis	Bhadrase	Apr-Jun	3	10-20*	3	15-20*
Eleagnus latifolia	malido	Feb-Mar	-	-	6	10*
Emblica officinalis	Amala	Oct-Jan	3	4*	-	-
Ficus benjamina	Kabra	Feb-mar	5	8-10*	2	15-20*
Heracleum wallichii	Chimfing	Jul-Aug	4	10+	3	80*
Juglans regia	Okhar	Sep-Nov	8	20#	14	50#
Machilus edulis	Pumsi	Jan-feb	8	15*	12	20-25*
Rhus succedanea	Timur	Aug-Sep	3	2-3+	5	3-5++
Rumax nepalensis	Halhale	Whole year	4	10*	6	2++
Spondias axillaris	Labsi	Oct-Dec	7	4*	10	5*
Swertia chirata	Chirauto	May-Oct	4	15-20*	3	20-30*
Tamarindus indica	Titri	Feb-May	8	5*	10	8*
Terminalia belerica	Barra	Whole year	3	20*	2	-
T. chebula	Harra	Feb-Mar	5	20#	5	25-30#
Urtica dioica	Sisnoo	Feb-Mar	7	5++	6	3++
Viscum album	Harchur	Whole year	6	5-10*	4	15*

*per kg, #per 100 units, +per 50 g, ++per 100 g

Table 14. Some important wild plants available in the weekly market at Namchi and Gangtok in Sikkim.

e.g. Pipin system in North district of Sikkim, allow to collect such wild edible species in a much organised way. Pipin, the village head, announces a date and area to collect a few wild edible species (i.e. *Arisaema utile* etc.) and persons from all the families of the village move simultaneously to collect these species. Next year a new area is opened and after collection, protected and banned for next 3-4 years. Consumption of these wild edible plants have decreased over the years due to unavailability of a number of species.

Interview with the villagers revealed that they are willing to raise a number of wild edible plants, particularly trees, in their farms, viz., *Spondias axillaris, Bassia butyracea, Elaeagnus latifolia, Baccaurea sapida,* etc. A few farmers have been already growing a some of these species but supply of seedling/saplings is the real problem. Still there is very less information about the nutrient composition of the most of these wild edible species. For most of the species, fruits are available for a short period in the market and sold at a low price. This is due to short keeping quality of these species. Such species can be available for a long duration if their keeping quality is increased or some value addition is done to them.

Medicinal plants are collected in bulk particularly at higher elevations. Similarly a variety of orchids are also collected from natural habitats. Such extraction has affected the natural regeneration of various species. The Government of Sikkim is aware of the extent of the problem and seriously considering to grow medicinal plants and orchids in the farmers fields in near future to avoid illegal encroachment and to fetch the better prices to local (Sundriyal and Sharma 1995).

Conclusions

World over tribal population still store a vast knowledge of using local plants as food material and other specific uses. There is need to survey more and more areas before the habitats are threatened due to over exploitation of resources. In Sikkim also a considerable portion of tribal food need is met from forests and other wild areas. Collection of wild plants play a major role in the economy of a few poor hill people as they sell these plants to the nearby markets. These plants are available for short duration and due to low keeping quality they are sold at low prices. Some of these species can certainly boost the economy of poor people if value addition is done to them, as is being done to some wild plants in the other parts of the Himalaya (Dhyani and Khali 1993; Maikhuri *et al.* 1994). There is a need to do further survey to see more species of potential use, their growth as well as their nutritional status. Due to habitat destruction some species are under threat of becoming extinct. At the same time some other species have the scope of domestication, though it need an in-depth study to avoid adverse effects, if any, by introducing a new species. Wild stock of various species sometimes face destructive harvesting

practice by locals as branches are lopped to collect fruit in a short time. These species can be conserved by cultivation in farm lands *(ex situ)* and farmers have shown their desire to grow a few selected species if planting material is made available to them. There is also a need for *in situ* conservation of representative viable population of various species. Perhaps an awareness campaign regarding the value of natural resources and their wise use could help to maintain and preserve these species for long.

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Apendix I. Important wild edible species and their distribution in the Sikkim Himalaya.

Name of species	Common name	Family	Plant habit	Distribution (m *amsl*)	Plant part used	Availability
Abroma augusta L. (0658)	Chuit	Sterculiaceae	S	300-1000	Roasted seed and oil	10-1
Acer papilio Tournef. (0545)	Kapashe	Aceraceae	T	2500-3100	Sweet sap is relished	1-12
Actinidia callosa Lindl. (0592)	Thekiphal	Actinidiaceae	W-c	1200-1800	Fruit	11-12
Actinidia strigosa Hook. (0600)	Thekiphal	Actinidiaceae	W-c	1000-1600	Fruit	10-11
Agalaia edulis A. Gray. (0566)	Sanulahsune	Meliaceae	T	500-1000	Fruit	3-6
Agaricus spp. (0632)	Chayo (4 var.)	Basidiomycetes	P	700-2500	Fruiting body	6-8
Allium sikkimensis Baker (0671)	Ochaurimuchi	Liliaceae	H	2500-3500	Plant leaves	7-8
Allium macranthum Baker. (0618)	Jimbo	Liliaceae	H	2000-2500	Whole plant, bulb	6-7
Ampelocissus lancifolius Plunch (0716)	-	Vitaceae	C	300-1000	Fruit	7-8
Angiopteris evecta (Forst.) Hoffm. (0642)	-	Filices	H	500-2200	Rhizome	1-12
Antidesma acuminatum Wall. (0573)	Kalo Bilaune	Euphorbiaceae	S	300-900	Fruit	12-1
Ardisia crispa (Thunb.) DC. (0633)	Cham	Myricinaceae	S	1200-1800	Flower	11-12
Ardisia macrocarpa Wall. (0612)	Damaigera	Myricinaceae	S	1400-2000	Berries	10-4
Arisaema utile Hook. f. (0685)	Banko	Liliaceae	H	>3000	Root tuber	7-8
Artocarpus lakoocha Roxb. (0527)	Badar	Urticaceae	T	300-1000	Fruit	6-8
Arundinaria sp. Gamble (0625)	Malingo	Poaceae	W-g	1300-2500	New shoots	1-12
Baccaurea sapida Roxb. (0505)	Kusum	Euphorbiaceae	T	300-600	Fruit	5-6
Bassia butyraceae Roxb. (0504)	Churi	Sapotaceae	T	500-1200	Fruit	5-6
Bauhinia purpurea L. (0584)	Tanki	Caesalpinioideae	T	300-1200	Pod/seed	2-4
Bauhinia vahlii Wt. & Arn. (0701)	Bhorla	Caesalpinioideae	W-c	500-1000	Pod	1-2
Bauhinia variegata L. (0547)	Koiralo	Caesalpinioideae	T	500-800	Leaves, flower bud	3-4
Begonia rubrovenia Hk. (0707)	-	Begoniaceae	H	500-1500	Cornaceae	4-5
Benthamia capitata Wall. (0601)	-	Cornaceae	T	1200-2200	Pulp is ralished	1-12
Berberis cristata DC. (0620)	Churto	Berberidaceae	S	1800-3000	Berries	10-11
Berberis asiatica Roxb. (0691)	Kissu	Berberidaceae	S	1500-2200	Berries	9-10
Berginia ciliata (Har.) Stenb. (0510)	Pakhanbhed	Saxifragaceae	H	1500-2800	Dried plant as medicine	11-12
Bistorta vivipara Linn. (0672)	-	Polygonaceae	H	1500-2500	Whole plant	7-8
Casearia glomerata Roxb. (0714)	Barkunle	Samydaceae	T	1000-1700	Foliage	4-5
Calamus erectus Roxb. (0714)	Betphal	Arecaceae	W-g	300-1500	Fruit	3
Calamus flagellum Griff. (0546)	Betgainra	Arecaceae	W-g	300-1500	Bud/seed as betel n.	3-4
Callicarpa arborea Roxb.(0565)	Guyenylo	Verbenaceae	T	300-1200	Fruit	11
Camellia kissi Wall. (0669)	Sissi	Actinidiaceae	S	1000-1700	Leaves subs. for tea	1-12
Canarium bengalense Roxb. (0684)	Marockpa	Burseraceae	T	< 500	Fruit	1
Cardamine griffithii H.F.&T.	-	Cruciferae	H	3000-3800	Plant	6-8
Caryota urens L. (0703)	Rangbhang	Palmae	T	300-1500	Fruit	1
Cassia fistula L. (0548)	Rajbriksh	Caesaiiaceae	T	300-1000	Pulp/fruit	4-5

continued

Castanopsis purpurella (Mig) Balakr (0509)	Katus	Fagaceae	T	1200-1500	Nut 11-12
Castanopsis hystrix DC (Sm) (0581)	Patle-katus	Fagaceae	T	600-2000	nut 10-12
Cayratia carrnnosa (Wall) Gagnep. (0683)	Amarbel	?	C	600-1500	Berries 9-12
Cephalostachyum capitatum Munro. (0512)	Tama-bans	Poaceae	W-g	600-2000	New shoots 6-10
Celosia sp. L. (0631)	Lalisag	Amaranthaceae	H	1200-1700	Leaves 1-6
Chassalia ophioxyloides Thcyaib.(0670)	-	Rubiaceae	S	500-1800	Foliage 3-7
Chenopodium album L. (0529)	Lattey sag	Chenopodiaceae	H	2500-3500	Plant 7-8
Cinnamomum impressinervium Meissn. (0708)	Sissi	Lauraceae	T	1000-2000	Fruit/leaves, Bark spices 2/1-12
Cinnamomum tamala Nees. (0641) spices	Tejpat, Sinkoli	Lauraceae	T	1200-1600	Leaves/bark 1-12
Cissus adnata Roxb. (0562)	Charchare	Vitaceae	W-c	300-1000	Berries/Leaves 2
Cissus repens Lamk. (0572)	Pureni	Vitaceae	W-c	300-1000	Berries 9-10
Cissus repanda Vahl. (0593)	Panilahera	vitaceae	W-c	400-800	Plant 6-9
Citrullus colocynthis Schrad. (0511)	Indrani	Cucurbitaceae	C	1500-2000	Roasted seeds 9-10
Clausena dentata Burm. (0635)	-	Rutaceae	T	800-1800	Fruit 5-6
Clausena willdenowii Wi&Arn. (0594)	Sidemyok	Rutaceae	T	900-1700	Fruit 7
Corylus ferox Wall. (0695)	Lekh katus	Corylaceae	T	2000-3000	Fruit 7-11
Cyathea brunoniana C.B.C.&Baker (0627)	Pashien	Filices	T-f	1200-2000	Stem pith 1-12
Cycas pectinata Griff. (0702)	Thakal	Cycadaceae	T	<1000	Fruit 12-1
Debregeasia wallichiana Wedd. (0582)	Bahunilahara	Urticaceae	T	1200-2300	Fruit 7-8
Decaisnea insignis Hk f. & Thoms. (0705)	Bherasingh	Berberidaceae	S	1000-1500	Fruit ?
Dendrocalamus hamiltonii Nes. & Arn. (0528)	Tamba	Poaceae	W/g	300-1750	Shoot 6-9
Dillenia indica L. (0564)	Panchpal	Dilleniaceae	T	300-1000	Fruit 3-4
Dillenia pentagyna Roxb. (0630)	Tautri	Dilleniaceae	T	300-500	Fruit/flower bud 5-6/4
Dioscorea bulbifera Br. (0654)	Bantarul	Dioscoreaceae	C	500-1500	Root tuber 11-4
Diplazium esculentum (Retz.) S. (0652)	Niguro (3 var.)	Polypodiaceae	H	900-1800	Young levas 3-5
*Elaeagnus latifoli*a L. (0503)	Goeli, Muslendi	Elaeagnaceae	S	1200-1800	Fruit 3-4
Elaeocarpus lanceaefolius Roxb. (0507)	Bhadrasey	Elaeocarpaceae	T	1300-2200	Fruit 9
Elaeocarpus sikkimensis Mast. (0508)	Bhadrasey	Elaeocarpaceae	T	1200-2200	Fruit 7
Emblica gamblei Kurz. (0563)	Patiamala	Euphorbiaceae	W-c	2000-2800	Foliage 1-12
Emblica officinalis Gaertn. (0513)	Amala	Euphorbiaceae	T	300-1000	Fruit 10-3
Entada scandans Benth. (0595)	Pngra	Mimosoideae	W-c	300-700	Soaked/boiled seeds 10-1
Eriolobus indica Sch. (0506)	Mehel	Rosaceae	T	1200-1800	Fruit as pickle 1-2
Eryngium foetidum L. (0604)	Brahmadhania	Apiaceae	H	1300-1800	Leavea as pickle 1-12
Eurya acuminata DC. (0530)	Jhingini	Actinidiaceae	T	1000-2200	Beverages 1-12
Eugenia kurzii (0715)	Ambakey	Myrtaceae	T	1200-1800	Fruit 2-3
Evodia fraxinifolia Hk. f. (0590)	Khanakpa	Rutaceae	T	1000-2200	Fruit 10-11
Fagraera oxyphylla Edgew. (0514)	Timur	Rutaceae	S	1800-2700	Foliage/berries 10-1
Ficus benjamina L. (0622)	Kabra	Moraceae	T	300-1000	Young leaves 3-4
Ficus glomerata Roxb. (0696)	Dumri	Moraceae	T	400-1000	Fruit 5-6
Ficus hirta Vahl. (0561)	Khashreto	Moraceae	T	1000-1600	Fruit 8
Ficus hispida Linn. (0636)	Koksa	Moraceae	T	900-1500	Fruit 8
Ficus hookeri Roxb. (0515)	Nebara	Moraceae	T	300-2000	Fruit 11
Ficus infectoria L. (0579)	Kabra	Moraceae	T	300-1000	Young leaves 3-4
Ficus roxburghii Roxb. (0648)	Nebara	Moraceae	T	300-1800	Fruit 4
Fragaria vesca L. (0558)	Bhui aselu	Rosaceae	H	2500-3500	Fruit 9-10
Garuga pinnata Roxb. (0717)	Dabdabe	Bursereaceae	T	300-900	Fruit 8-9
Garcinia unitoria (DC) Wt. (0673)	Chunyel	Tropoeliaceae	T	300-1000	Fruit 3-4
Gaultheria fragrantissima Wall. (0506)	Machino	Ericaceae	S	1800-2800	Fruit 9-10
Girardinia palmata Gand. (0585)	Bhangresisnoo	Urticaceae	H	900-2500	Young shoots 3-5
Grewia elastica Roxb. (0596)	Kunsung	Tiliaceae	T	300-1000	Fruit 2-5
Grewia sapida Roxb. (0621)	Kuail	Tiliaceae	T	300-700	Fruit 2-4
Grewia vestita Roxb. (0531)	Syalphusrey	Tiliaceae	T	300-1000	Flower bud 4-5
Gynocardia odorata R. Br. (0653)	Bandre, Gante	Flacourtiaceae	T	300-1200	Pulp 11-1
Heracleum wallichii DC. 905160	Chimphing	Apiaceae	S	1500-3300	Fruit in pickle 10
Hodgsonii macrocarpa (Bl) Cogn. (0606)	Darsani	Cucurbitaceae	C	300-1000	Seed oil 6-11
Holboellia latifolia Wall. (0614)	Kuolrik	Berberidaceae	C	1000-1600	Fruit 10-11
Horsfieldia kingii Warb. (0706)	Runchepat	Myristicaceae	T	400-900	Fruit 1-4
*Hottuyrnia cordat*a Wall. (0674)	Hiley-jhar	Piperaceae	H	1300-2500	Plant 7-8
Hovenia dulcis Thunb. (0559)	Bangikath	Rhamnaceae	T	500-1500	Fruit 8-2
Indigofera atropurpurea Horn em. (0637)	-	Leguminosea	S	800-1300	Pod
Indigofera cassioides Rottl. (0718)	-	Leguminosea	H	800-1400	Pod
Juglans regia L. (0532)	Okhar	Juglandaceae	T	1000-1600	Fruit 9-11
Kadsura roxburghiana Arn. (0721)	Pattiamalo	Schizandraceae	W-c	500-2200	Seed 8-9
Laurocerasus undulata Roem. (0597)	Lekh arupate	Rosaceae	T	2400-3200	Fruit 10
Leea macrophylla Roxb. (0624)	Bulyettra	Vitaceae	S	500-1300	Brries 10-11
Leea sambuciana Willd. (0639)	Galene	Vitaceae	S	500-1300	Berries 8-10
Litsaea citrata Bl. (0517)	Siltimur	Lauraceae	T	1300-1800	Fruit as pickle 3-5
Machilus edulis King (0502)	Kawlo/Pumsi	Lauraceae	T	1100-2000	Fruit 1-3
Maesa chisia D.Don (0586)	Bilaune	Myrsinaceae	S	1000-2000	Fruit 4-8
Mahonia sikkimensis Takeda. (0577)	Chutro/Keshri	Berberidaceae	S	1300-2400	Beries 3-4
Malus sikkimensis (0533)	Aiphal/tipsi	Rosaceae	T	2000-3000	Fruit 10
Mangifera sylvatica Roxb. (0603)	Chuche anp	Anacardiaceae	T	500-1000	Fruit 7-10
Melia composita Willd. (0556)	Lapsi/Silotkung	Meliaceae	T	500-1800	Fruit 1
Momordica chochinchinensis Bon. (0607)	Bon-karela	Cucurbitaceae	C	400-1600	Fruit 6-7
Morus australis Poir (06380	Sanukimbu	Moraceae	T	500-1200	Fruit 4-5
Morus laevigata Wall. (0518)	Kimbu	Moraceae	T	500-1300	Fruit 5-6
Murraya koenigii Spreng. (0655)	Mechia sag	Rutaceae	S	300-1200	Leaves in curries 1-12
Musa bulbisiana Colla. (0543)	Bankera	Musaceae	T-h	400-1600	Fruit 1-12

Mussaenda roxburghii Roxb. (0570)	Dobiphul	Rubiaceae	S	1200-1500	Bud	6-8
Myrica gale L. (0598)	Kaphal	Juglandaceae	T	1400-2000	Fruit	2-4
Nasturtium officinale Br. (0519)	Simrayo	Brassicaceae	H	1400-1600	Shoot	5-8,11-1
Paeonia emodi Wall. ex royal (0682)	Bhuma madrya	Ranunculaceae	H	2000-3000	Shoot	1-12
Pandamnus nepalensis (0534)	Tarika	Pandanaceae	T	400-1200	fruit	6-8
Parthenocissus himalayana Planch. (0688)	Charchare	Vitaceae	W-c	1500-3000	Fruit	9
Pentapanax leschenaultii Seem. (0537)	Chindney	Araliaceae	C	1700-2700	New shoots as pickle	3-5
Pentapterygium serpens Klotzch. (0578)	Harchur	Vaccinaceae	S	1500-2500	Fruit	4-6
Phlogacanthus thyrsiflorus Nees. (0610)	Chua	Acanthaceae	S	800-1200	Flower	1-3
Phoenix acaulis Roxb. (0542)	Thakul/Schap	Arecaceae	T	900-1200	Fruit as betel nuts	3-5
Phoenix rupicola T. Anders (0615)	Schap	Arecaceae	T	1000-1200	Pith of stem	1-12
Phytolacca acinosa Roxb. (0557)	Jaringo	Phytolacceae	H	1300-1800	New leaves/twigs	5
Piper nepalense Miq. (0571)	Khorsani	Piperaceae	S	1200-2000	Fruit	10
Podophyllum emodi (0535)	Papri	Berberidaceae	H	3000-4000	Fruit	6-7
Portulaca oleracea L. (0722)	Dalda sag	Portulaceae	H	600-1500	Young shoots	5-7
Polygonum molle D.Don (0521)	Thothne	Polygonaceae	H	2500-3500	Young shoots	3-4
Prinsepia utilis Royal (0697)	Phekrey	Rosaceae	S	1200-3000	Seed oil	3-4
Prunus cerasoides D.Don (0520)	Paiyun	Rosaceae	T	1200-1600	Fruit	4-5
Pyrularia edulis A. DC. (0640)	Amphi	Santalaceae	T	700-1800	Fruit	7-10
Pyrus pashia D.Don (0536)	Naspati	Rosaceae	T	1400-1600	Fruit	11-12
Rheum nobile Hk. f. & Rhoms (0720)	Tohuka	Polygonaceae	H	3500-4000	Leaves, petiole	7-8
Rhododendron arboreum Sm. (0522)	Gurans	Ericaceae	T	1700-2800	Beverages	3-4
Rhus semialata Murr. (0539)	Bhakimlo	Anacardiaceae	T	600-1800	Fruit as picle	10-12
Rosa macrophylla Lindl. (0554)	Bangulab	Rosaceae	S	1200-3600	Fruit	7-10
Rubus calycinus Wall.(0609)	Bin aselu	Rsaceae	S	2000-2700	Fruit	7-11
Rubus ellipticus Smith. (0523)	Aselu	Rosaceae	S	1200-2100	Fruit	4-6
Rubus niveus Thunb. (0623)	Kalo aselu	Rosaceae	S	1000-1300	Fruit	6-10
Rumex nepalensis Spreng. (0576)	Halhale	Polygonaceae	H	1400-2700	Shoot	1-12
Salmalia malabarica Schott. (0538)	Simal	Bombacaceae	T	500-1500	Seed	4-5
Sapindus detergens Wall. (0599)	Ritha	Sapindaceae	T	300-1000	Seed	1
Saurauia napaulensis DC. (0605)	Gogun	Saurauiaceae	T	300-1200	Fruit	10-12
Saurauia punduana Wall. (0553)	Safa	Saurauiaceae	T	300-1200	Fruit	10-12
Saurauia roxburghii Wall. (0677)	Dangsipha	Saurauiaceae	T	300-1000	Fruit	2
Schizandra grandiflora Hk.f.&T. (0589)	Singara/lahra	Magnoliaceae	W-c	1800-2800	Fruit	6-10
Shorea robusta Roxb. (0659)	Sakuwa	Dipterocarpaceae	T	300-900	Seed oil	5-6
Smilacina oleracea Hk.f.&T. (0617)	-	Liliaceae	H	2500-3500	Flower	6-8
Sorbus cupsidata Hedl. (0676)	Tenga	Rosaceae	T	2500-3200	fruit	11-12
Spondias axillaris Roxb. (0501)	Lapsi	Anacardiaceae	T	500-1500	Fruit	10-12
Sterculia fulgens Wall. (0575)	Labshi	Sterculiaceae	T	500-900	Root of young trees	1-12
Sterculia indica Meorill. (0689)	Chiuripat	Sterculiaceae	T	500-1300	Fruit	5-7
Sterculia pallens (0569)	-	Sterculiaceae	T	300-1000	Seed	5-6
Sterculia roxburghii Wall. (0681)	Chiuripat	Sterculiaceae	T	300-1400	Seed	5-6
Swertia chirata Ham. (0552)	Chirauto	Gentianaceae	H	1500-2500	Decoction as medicine	5-10
Syzigium claviflorum Wall. (0690)	Harejamun	Myrtaceae	T	500-1000	Fruit	8-10
Syzigium tetragonum Wall. (0723)	Chamlaney	Myrtaceae	T	1200-1800	Fruit	3
Taxus baccata L. (0587)	Cheongbu	Taxaceae	T	1800-3500	Fleshy axil	9-11
Tamarindus indica L. (0540)	Titri	Caesalpinioideae	T	300-600	Fruit	3
Terminalia belerica Roxb. (0568)	Barra	Combretaceae	T	300-900	Fruit as medicine	12-1
Terminalia chebula Retz. (0580)	Harra	Combretaceae	T	300-900	Fruit/rind	12-1
Tetrastigma bracteolatum Planch. (0719)	Tolndorrik	Vitaceae	W-c	1000-1600	Fruit	12-1
Tetrastigma rumicispermum Planch. (0719)	-	Vitaceae	W-c	1500-2300	Fruit	10-11
Theropogon pallidus Maxim. (06980	Chhikko	Liliaceae	H	1800-3000	Root bulb	7-8
Tupistra nutans Wall. (0541)	Nakima	Liliaceae	H	300-1500	Flowering spike	9
Turpinia pomifera DC. (0700)	Thali, Nagpat	Staphyleaceae	T	750-1200	Fruit	9-12
Urtica dioica L. (0524)	Patle sishnu	Urticaceae	H	1200-2000	New leaves	1-12
Urtica parviflora Roxb. (0525)	Sisnoo/Surang	Urticacieae	H	1200-2000	Leaves/flowering twigs	1-12
Vaccinium vacciniaceum (05880	Cham	Vacciniaceae	E	1200-1800	Flower	5
Viscum articulatum Burm. f. (05440	Harchur	Loranthaceae	E	500-1500	Plant as medicine	1-12
Wallichia disticha T.Anders. 90555)	Thakal	Palmae	T	300-900	Pith as sago	1-12
Zanthoxylum budrunga Wall. (0526)	Boketimur	Rutaceae	S	300-1000	Fruit as pickle	7-8
Zanthoxylum hamiltonianum Wall. (0574)	Parpartimur	Rutaceae	S	1000-2000	Fruit	1

Symbols: T=Tree, S=Shrub, H=Herb, C=Climber, W-c=Woody climber, E-Epiphyte, T-g=Tree grass, T-f=Tree fern, T-h= Tree herb, W-g= Woody grass, P=Parasite. Values in parenthesis are herbarium numbers. Availability of plants edible parts is expressed in terms of 1 (January) through 12 (December) months.