Addressing The Issues Of Hidden Hunger: Looking For Plants As Food Resources In The Wild

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Abstract*—Since ancient times, wild plants have been playing a very important role in human life in terms of food security and sustainable livelihood . The current study carried out to assess the diversity and consumption pattern of wild plants as food by tribal and rural communities of Koraput, Nabarangpur and Khurda districts of Odisha in a systematic manner documented 112 wild plant species distributed in 86 genera and spread over 51 families. The plant species recorded included 26 trees, 03 shrubs, 68 herbs and 15 climbers/creepers. Out of 112 plant species recorded, 83 were used as green leafy vegetables and others as edible fruits, tubers, seeds etc. eaten either in raw or cooked form. The plants used widely as leafy vegetables included Achyranthes aspera, Alternanthera sessilis, Centella asiatica, Bauhinia purpurea, Emilia sonchifolia, Hibiscus sabdariffa, etc. Similarly plants such as, Dioscorea, Madhuca longifolia, Coccinia grandis, Ficus hispida, etc. were important for consumption of their edible parts such as tuber, flower, fruit etc. Nutritional value of selected plant species showed that many of the wild plants consumed by tribal people were very rich in carbohydrate and protein content besides fat. Azadirachta indica, Oxalis corniculata Polygonum plebeium, Talinum portulacifolium, Ficus racemosa, Ziziphus oenopolia etc. were rich in protein. Analysis for specific nutrients reflected that many plant species were rich in Calcium, Magnesium, Iron and Potassium besides vitamins having the potentialiy to meet the challenges of hidden hunger. Plants such as Alternaria sessilis, Centalla asiatica, Cinnamomum album Cleome gynandra Commelina benghalensis, Glinus oppositifolius Murrya koenigii, were very rich in Calcium content. High content of iron was noted in Centalla asiatica, Enydra fluctuans, Talinum portulacifolium, Ficus racemosa etc. Many plant species were rich in vitamins such as A, B and C. In addition to their dietary uses, many plants species were noted to have medicinal values as well. The study tried to provide baseline data which could be useful for prioritization of conservation, besides sustainable use and management of the resources keeping the regional food security in view.

Keywords—Plant bio-diversity, Wild Edible Plants, Leafy vegetables, Food security

1. INTRODUCTION

Food is the basic need of every individual and stands first among the hierarchical needs of human beings. As such it is the right of every person to have regular access to sufficient nutritionally adequate and culturally acceptable food for an active and healthy life. The Food and Agriculture Organisation (FAO,) of United Nations has observed that almost one-sixth of all humanity do suffer from hunger. According to a recent report from UNO, of about 900 million people who are under extreme poverty, 300 million are from India that stands 94th position(1) in the global hunger index. At certain remote areas, chronic food insecurity persists and families often go empty stomach and eat on alternate days. Though the National Food Security bill enshrines freedom from hunger and malnutrition as a fundamental right, being grilled under poverty, people often search for wild plants and their parts such as fruits, seeds, roots, leaves, tubers etc. to meet their hunger.

Along with hunger, India has the largest number of malnourished people in the world amounting to about one third of the total two billion people worldwide. Malnutrition in terms of deficiency of essential amino acids, vitamins, (Vitamin A and D) and microelements (such as iron, zinc, magnesium etc.) known as hidden hunger(2, 3) affects developmental processes including cognition level, blindness, and immunological malfunctioning etc. Most of the malnourished individuals include infants, children and women in resource poor families.

About 75 per cent of the Indian people do live in the rural areas. Wild plants play a major role in meeting the nutritional requirement of the tribal and rural population in remote parts of the country throughout year besides the periods of food crises (4). But in recent times, this age old practice in many tribal communities are at risk and gradually getting declined. Hence there is an urgent need to study and document the wild edible plants from ethno botanical approach and find innovative ways of tapping their potential for the welfare of mankind (5).

Odisha, one of the eastern states of India has the oldest and richest cultural traditions of using plants for various ethno botanical purposes. Its diverse topography has permitted the survival of traditional knowledge related to plant resources being used by locals as food and medicine. In spite of the potentiality wild plants being used for human nutrition in Odisha, very little work has been carried out (6,7,8) and the area still stands largely incomplete and unexplored.

Under this back ground , the present study was undertaken with the aim of documenting and analysing the wild food plants consumed by people of different tribal and rural villages of Koraput, Nabarangpur and Khordha districts of Odisha.

The specific objectives (s) of the study were

i) to identify the plants used for food purposes by the local people

ii) to study the plant part being used for food and

iii) to search and analyse the nutritional value of the used plant parts.

2. MATERIAL AND METHODS

Study area: The present study was carried out in three districts, Koraput, Nabrangpur and Khordha of Odisha state. Koraput (18°13' to 19°10' N, 82°5' to 83°23' E) and Nowrangapur (19^0 10' to 20^0 6' N, 81^0 51 to 82^0 52' E) located in the Southern part of Odisha is mostly tribal dominated with low literary rate (Fig.1). Most parts of the districts under study are covered with forest forming a part of the Eastern Ghats of India. Major ethnic groups, viz., Paraja, Bhumia, Gadaba, Kandha, Koya, Paika, Saura, and other tribes inhabit these districts. Khordha district, stands (19°40' to 20°25' N, 84°40' to 86°5' E) in the eastern part of the state and is mostly influenced by modernity (Fig.1). The tribal and rural poor people often consume many of the wild plants as food/vegetables available in their surroundings regularly and during food scarcity as well.

Observation, Plant Identification and Collection of Ethno-botanical Data:

An extensive field survey was conducted in different tribal and rural villages of Koraput, Nabarangapur and Khordha districts of Odisha. Under the program , the researcher visited the study areas during different seasons to collect relevant information relating to the consumption of food plants growing in the wilderness. During the visit, the elderly tribal/non-tribal men and women were identified and interviewed to collect useful information on the wild food plants.

To begin with , a questionnaire developed with the help of experts collected information(s), such as the local (Odia) name of the plant, parts used, method of collection of plant part(s), method of use as well as food preparations. The data collected in this study was based on first hand information. All the gathered information(s) were cross checked with the people of other nearby villages. Also comparison was made between the information collected from the people and the available literature wherever possible . Efforts were made to collect plant specimen in flowering / fruiting condition and brought into the laboratory for further identification. The plants were identified following the "Flora of Odisha" (9). The herbaria of collected plants are available in the Botany Department of Regional Institute of Education, Bhubaneswar.

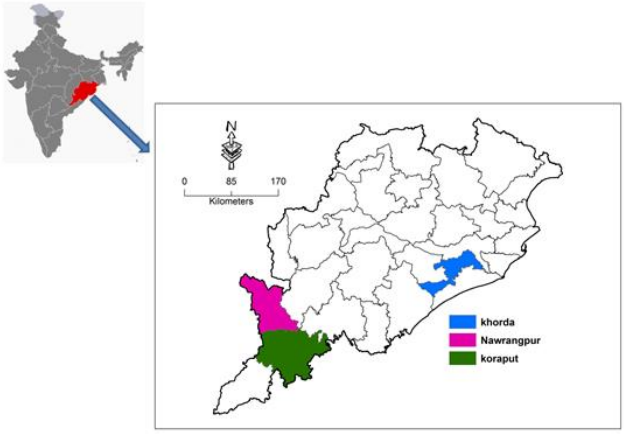

Fig 1 Map Showing the Study Area(s)

After finding the plant part(s) and its mode of consumption / food preparation, a thorough search was made in the literature to find out the quality and quantity of nutrients if any. present in the selected plants.

3. RESULT

The current study carried out to assess the diversity and consumption pattern of wild plants as food by tribal and rural communities of Koraput, Nabarangpur and Khurda districts of Odisha revealed that 112 wild plant species distributed in 88 genera spread over among 53 families (Table 1). The plant species recorded included 26 trees, 03 shrubs, 68 herbs and 15 climbers/creepers (Fig.2), of which major plants were from dicots (95) leaving few under monocot (17) The largest number of plant species were distributed under family Amaranthaceae (11), followed by Brassicaceae (6) and Cucurbitaceae (6) (Fig.4).

The plant part and their mode of consumption as food material were also recorded. It was noted that leaves from most plant species were used for food followed by fruits, shoots and flowers (Fig. 4). Out of all plants documented, major plants were from the wild (78) collected by the local people, few plants were cultivated (14) and others were both from wild and cultivated forms (20) .

Out of 112 plant species recorded, 83 were used as green leafy vegetables and others as edible fruits, tubers, seeds etc. consumed either as raw or in cooked form. The plants used widely as leafy vegetables included *Achyranthes aspera, Alternanthera sessilis, Amaranthus viridis, Celosia argentea, Centella asiatica, Bauhinia purpurea, Enydra fluctuans Emilia sonchifolia, Hibiscus sabdariffa, Oxalis corniculata, Phyla nodiflora etc.* Similarly plants such as, *Dioscorea, Madhuca longifolia, Coccinia grandis, Ficus hispida, Borassus flabellifer, Trapa natans* var. *bispinosa, Limonia acidissima* etc. were consumed for their edible parts such as tuber, flower, fruit etc.

Analysis of the nutritional value of selected plant species (Table 2) showed that many of the wild plants consumed by tribal people were very rich in carbohydrate and protein content besides fat. Plant species such as *Cinnamomum tamala, Glinus oppositifolius. Murraya koenigii, Oxalis corniculata, Rivera hypocrateriformis, Dioscorea pentaphyla Ziziphus oenopolia* etc. were rich sources of carbohydrate. Similarly, *Azadirachta indica, Oxalis corniculata Polygonum plebeium Talinum portulacifolium, Ficus racemosa, Ziziphus oenopolia* etc. were rich in proteins. Analysis for specific nutrients (Table 3) reflected that many plant species were rich in Calcium, Magnesium, Iron and Potassium besides vitamins. Plants such as *Alternaria sessilis, Centalla asiatica, Cinnamomum album Cleome gynandra Commelina benghalensis, Glinus oppositifolius Murrya koenigii* etc. were very rich in Calcium content. High content of iron was noted in *Centalla asiatica, Enydra fluctuans, Talinum portulacifolium, Ficus racemosa* etc. Many plant species were rich in vitamins such as A, B and C (Table 3).

Interestingly, in addition to their dietary uses, many plants species such as *Achyranthes aspera, Centella asiatica, Mitracarpus histus*, *Leucas aspera, Paederia foetida* etc. had medicinal values as well. Further Some plants such as *Azadirachta indica, Aegle marmelos*, *Ficus benghalensis*, *Syzygium cumini*, *Diospyros malabarica* etc. *had* got religious importance. Similarly plants like *Nelumbo nucifera, Nymphaea alba* etc. were having ornamental importance and plants like *Bauhinia vahlii, Borassus flabellifer***,** *Diospyros melanoxylon*, *Madhuca longifolia*, *Phoenix sylvestris*, *Phyllanthus emblica Trapa natans* var. *bispinosa , Alternanthera sessilis* etc. were exploited by the local inhabitants for their sustainable livelihood (Fig.5).

4.DISCUSSION

From the present study it was noted that tribal and rural people from the Koraput, Nabarangpur and Khorda districts of Odisha used 112 different wild plant species as their food. The edible parts consumed include fruits, leafy vegetables, seeds, shoots and edible underground parts. The wild food plant parts were mostly collected free from the local forest/wilderness, washed properly, boiled or cooked, sliced and then eaten. In India, the tribal and rural people traditionally use about 9500 wild plants for various purposes such as medicine, food, fodder, fuel, fibre, essence, culture and other miscellaneous purposes from which about 3900 wild plants(10,11) are used as food , consumed mostly during emergency (12). Non availability of sufficient food, poor accessibility and marketability besides low agriculture yield were the main reasons for use of wild plant parts as food items as observed in the present study . Besides being used as sources of food , these wild plants were also exploited for their medicinal properties and used against various diseases by the local communities through their indigenous knowledge. Many of these wild plants are getting depleted due to population explosion and other anthropogenic activities such as construction of roads, housing, agricultural land expansion, and degradation of forests besides lack of sustainable harvesting practices.

Interestingly, it was noted that most of the wild food plants were rich in basic nutrients (protein, carbohydrate and fat),vitamins and minerals that has the potentiality to fight against malnutrition and hidden hunger(2, 3) among tribal and rural communities. Though there are various means of meeting the challenges of food insecurity and malnutrition, through plant breeding and other biotechnological processes (11) such as tissue culture, distant hybridization etc, one of the easiest ways is to search for traditional plant resources growing in the wild and are rich in various nutrients. Very recently FAO, the UN food agency has warned that protecting the world's food supply is critical as the biodiversity that underpins our food systems(13), is declining at all levels around the world pushing the planet's population towards chronic hunger.

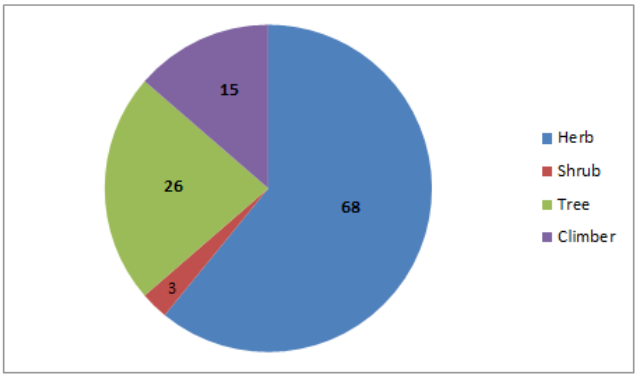

Figure. 2 Habit wise distribution of wild plants used as food material

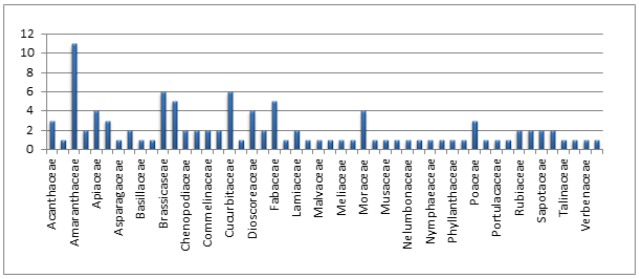

Figure 3. Distribution of wild food plants according to family

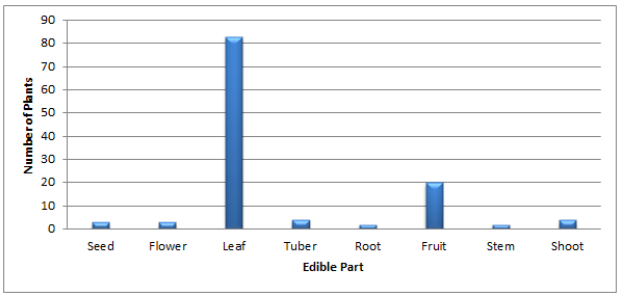

Fig.4 Plant parts used as Food

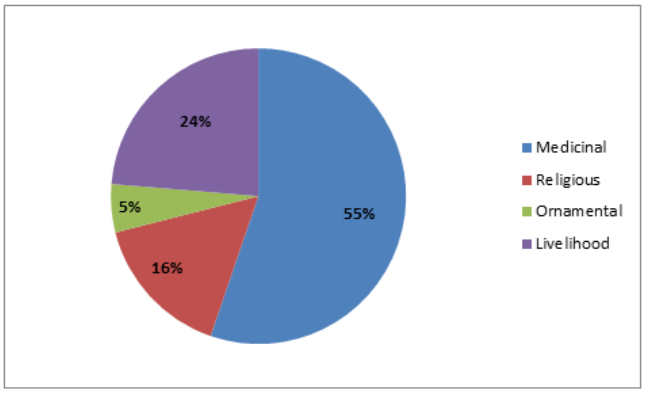

Figure. 5 Multiple Economic uses of wild plants besides being used as food material

Though culture and tradition of tribal and rural people play a major role for the conservation of biodiversity (14,15,16), efforts to conserve biodiversity and preserve traditional food systems need to be combined and enhanced for the benefits of the community. Further, the present study tried to provide a baseline data which could be useful for prioritization of conservation, besides sustainable use and management of the plant resources keeping the regional food security in view. Further, the rural community may be made aware of the potentiality of the selected plant species available in their locality in meeting the challenges of malnutrition.

5. ACKNOWLEDGMENT:

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Table1. List of Wild Food Plants with their part used and Mode of Consumption

Sl. No	Name of the Plant	Family	Common Name (English)	Local (Odia) Name	Habit	Part Used	Mode of Consumption
1.	*Achyranthes aspera* L.	Amaranthaceae	Prickly Chaff Flower	Apamaranga	H	L	Young leaves and shoots are collected, roasted and eaten
2.	*Acalypha indica L.*	Euphorbiaceae	Indian Copperleaf	Mukta jhuri	H	L	Leaves are fried with oil, then eaten
3.	*Aerva lantana* (L.) Juss	Amaranthaceae	Mountain Knot Grass	Paunsia	H	L	Leaves are collected, fried and eaten
4.	*Allium cepa* L.	Amaryllidaceae	Onion	Piaja	H	L	Young leaves and shoots are collected, fried then eaten
5.	*Allium sativum* L.	Amaryllidaceae	Garlic	Rasuna	H	L	Young leaves and shoots are collected, fried then eaten
6.	*Allmania nodiflora* R.Br.	Amaranthaceae	Node Flower Allmania	Chadheimundia saga	H	L	Leaves and young shoot are roasted with mustard oil and then eaten.
7.	*Alternanthera ficoidea* (L.) Sm.	Amaranthaceae	Sanguinarea	Bana madaranga	H	L	Young leaves and shoots are collected, fried then eaten
8.	*Alternanthera sessilis* L.R. Br.	Amaranthaceae	Sessile Joyweed	Madaranga	H	L	Leaves and young shoot are roasted with mustard oil and then eaten
9.	*Amaranthus blitum* L.	Amaranthaceae	Purple amaranth	Kosila	H	L	Leaves and young shoots are cut into small pieces, cooked with salt and chilly and then eaten
10.	*Amaranthus caudatus* L.	Amaranthaceae		Khada saga	H	L	Leaves and young shoots are cut into small pieces, roasted then eaten
11.	*Amaranthus spinosus* L.	Amaranthaceae	Prickly amaranth	Kanta leutia	H	L	Leaves and young shoots are cut into small pieces, cooked with salt and chilly and then eaten.
12.	*Amaranthus tricolor* L.	Amaranthaceae	Chinese spinach/fountain plant	Lal Khada	H	L	Leaves are collected, fried/roasted then eaten
13.	*Amaranthus viridis* L.	Amaranthaceae	Wild amaranth	Leutia	H	L	Leaves and young shoots are collected, fried then eaten
14.	*Andrographis paniculata* (Burm.f.) Nees	Acanthaceae	Creat	Bhuin nimba/Chireita	H	L	Leaves are collected, fried and eaten
15.	*Arisaema tortuosum* (Wall.) Schott	Araceae	Whipcord Cobra Lily	Bana nada	H	L	Young shoot/Fruit stalk is fried to prepare curry and eaten
16.	*Azadirachta indica* A.Juss	Meliaceae	Neem	Neem	T	L	Fresh tender leaf along with flower is fried with mustard oil.
17.	*Bambusa bambos* (L.) Voss	Poaceae	Kanta baunsa	Indian Throny Bamboo	T	L	Young shoots (Karada) are cut into small pieces, cooked with salt and chilly and then eaten.
18.	*Basella alba* L.	Basillaceae	Indian spinach	Poi	C	L	Stem and leaves are used to prepare curry
19.	*Bauhinia purpurea* L.	Caesalpiniaceae	Geranium tree	Kuilari	T	L	Young shoots along with leaves are collected, cooked as curry or fried and taken.
20.	*Bauhinia vahlii* Wight & Arn.	Caesalpiniaceae	Camel's foot climber	Siali	C	L, Se	Young leaves are collected, cooked as curry and taken. Seeds are eaten after boiling or cooked as vegetable
21.	*Bauhinia variegata* L.	Caesalpiniaceae	Kachnor	Kanchan	T	L, Fl	Leaves are collected, cooked as curry and taken and flowers coated with rice powder are very good in taste after fried
22.	*Benincasa hispida* (Thunb.) Cogn.	Cucurbitaceae	Ash gourd	Panikakharu	C	L, Fr	Young shoots along with leaves are collected, cooked as curry or fried and then eaten. Fruit is commonly eaten as vegetable

23.	*Boerhavia diffusa* L.	Nyctaginaceae	Hog weed	Puruni saga	H	L	Tender leaves and young shoots are collected, fried/ roasted then eaten
24.	*Brassica napus* L.	Brassicaseae	Rape	Sorisa saga	H	L, Se	Chopped leaves and stems are dried in shade, stored in an eaten. Seed is used as spices and extraction of edible oil
25.	*Brassica oleracea* L. var *botrytis* L.	Brassicaceae	Cauliflower	Phula kobi	H	L, Fl	Leaves are fried or made into curry and consumed. Inflorescence commonly eaten as vegetable
26.	*Brassica oleracea* L. var capitata L.	Brassicaceae	Cabbage	Banda/patra kobi	H	L	Leaves are fried separately or with other vegetables, then eaten
27.	*Brassica oleracea L. var. gongylodes L.*	Brassicaceae	Knol-Khol	Gantthi/Ol kobi	H	L	Leaves are fried separately or with other vegetables, then eaten
28.	*Celosia argentea* L.	Amaranthaceae	Silver Cockscomb	Ghurudi sag	H	L	Young leaves and shoots are collected, roasted then eaten
29.	*Centella asiatica* L.	Apiaceae	Indian pennywort	Thalkudi	H	L	Leaves and young shoots are collected, roasted then eaten
30.	*Chenopodium album* L.	ChenopodiaceaeWhite goosefoot		Bathua saga	H	L	Leaves and young shoots are cooked along with other vegetable adding salt and chilly to it.
31.	*Cicer arietinum* L.	Fabaceae	Gram	Buta saga	H	L, Se	Young leaves and shoots are collected, roasted then eaten. seeds consumed as raw or cooked
32.	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.	Lauraceae	Indian cassia-lignea	Teja patra	T	L	Leaves are used as spice in making curry.
33.	*Cleome gynandra* L.	Cleomaceae	Spider flower	Araka saga	H	L	Leaves and young shoots are collected, roasted then eaten
34.	*Cleome viscosa* L.	Cleomaceae	Asian spider flower	Bana sorisa	H	L	Leaves and young shoots are collected, fried/ roasted then eaten
35.	*Colocasia esculenta* (L.) Schott	Araceae	Elephant ear taro	Saro	H	L, Tu	Leaves are collected, fried with oil then eaten. Tuber is consumed after cooking in curries
36.	*Commelina attenuata* K.D.Koenig ex Vahl	Commelinaceae	Asian spider flower	Chhena saga	H	L	Leaves and young shoots are collected, fried/ roasted then eaten
37.	*Commelina benghalensis* L.	Commelinaceae	Day flower	Kansiri	H	L	Leaves and young shoots are collected, fried/ roasted then eaten
38.	*Corchorus capsularis* L.	Tiliaceae	White jute	Nalita	H	L	Tender leaves are collected, curry is prepared and eaten.
39.	*Coriandrum sativum* L	Apiaceae	Coriander	Dhania	H	L	Leaves and shoots are collected, added to curry for aroma and also chutney is prepared from the fresh leaves.
40.	*Cucurbita maxima* Duchesne.	Cucurbitaceae	Sweet gourd	Kakharu saga	C	L, Fr	Leaves and young stems are collected, roasted then eaten. Fruit is commonly consumed as vegetable
41.	*Dendrocalamus strictus* (Roxb.) Nees	Gramineae (Poaceae)	Bamboo	Baunsa	T	Sh	Young shoots are cut into small pieces, cooked with salt and chilly and then eaten
42.	*Emilia sonchifolia* (L.) DC. ex DC.	Asteraceae	Purple Sow Thistle	Musakani sag	H	L	Tender leaves and young shoots are collected, cooked then eaten
43.	*Enydra fluctuans* DC.	Asteraceae	Water cress	Hidmicha	H	L	Leaves are cooked with mustard oil, chilly, salt and eaten
44.	*Eryngium foetidum* L.	Apiaceae	Long Coriander	Jangali dhania	H	L	Leaves and shoots are

							collected, added to curry for aroma and also chutney is prepared
45.	*Furcraea foetida* (L.) Haw.	Asparagaceae	Giant Cabuya	Muruga	S	L	Young shoots are collected, fried, then eaten.
46.	*Glinus oppositifolius* (L.)A.DC.	Molluginaceae	Gima	Pita saga	H	L	Young leaves and shoots are collected, roasted with other vegetables then eaten
47.	*Hibiscus sabdariffa* L.	Malvaceae	Roselle	Kanuria/Khatapalanga	H	L	The leaves are very sour in taste. So, leaves are collected, cooked with water and other vegetables to prepare sour water 'sambar'
48.	*Hybanthus enneaspermus* (L.) F.Muell.	Violaceae	Spade Flower	Luni saga	H	L	Leaves and young shoots are collected, fried/ roasted then eaten
49.	*Hydrolea zeylanica* (L.) Vahl	Hydroleaceae	Ceylon Hydrolea	Langulia	H	L	Leaves and young shoots are roasted and taken as food
50.	*Hygrophila auriculata* (Schumach.) Heine	Acanthaceae	Marsh Barbel	Khikri sag	H	L	Leaves are roasted with oil and then eaten
51.	*Ipomoea aquatica* Forssk.	Convolvulaceae	Swamp cabbage/water bindweed	Kalama saga	C	L	Leaves and tender shoots are collected, cooked and then eaten
52.	*Lagenaria siceraria* (Molina) Standl.	Cucurbitaceae	Bottle gourd	Laoo	C	L, Fr	Leaves and young stems are cooked with other vegetables. Fruit is consumed as vegetable
53.	*Lepidium sativum* L.	Brassicaceae	Garden grass	Himba saga	H	L	Leaves and young shoots are collected, roasted then eaten
54.	*Leucas aspera* (Willd.) Link	Lamiaceae	Common Leucas	Gayisa	H	L	Leaves are eaten after frying or roasting
55.	*Limnophila indica* (L.) Druce	Plantaginaceae	Indian Marshweed	Keralata	H	L	Leaves and young shoots are roasted and taken as food
56.	*Marsilea minuta* L.	Marsileaceae	Dwarf Water Clover	Sunsunia	H	L	Tender leaves and young shoots are roasted and taken as food
57.	*Mentha spicata* L.	Lamiaceae	Garden mint	Podina	H	L	Young leaves paste adding salt chilly is used as chantey
58.	*Mitracarpus hirtus* (L.) DC.	Rubiaceae	tropical girdlepod	Ganthia sag	H	L	Leaves are boiled with water and then eaten
59.	*Momordica charantia* L.	Cucurbitaceae	Bitter gourd	Kalara	H	L	Leaves are eaten after frying or roasting
60.	*Moringa oleifera* Lam.	Moraginaceae	Drum stick	Sajana	T	L, Fr	Leaves are eaten after frying and also added to curries and fruit is also used to prepare curries, sambar etc.
61.	*Murraya koenigii* L. Spreng	Rutaceae	Curry tree leaf	Bhursanga	T	L	Leaves are used as spice in curry and give it a specific scent. Also young leaves used to prepare chutny.
62.	*Oroxylum indicum* (L.) Kurz	Bignoniaceae	Midnight horror	Phapni sag	T	L	Leaves are eaten after frying or roasting
63.	*Oxalis corniculata* L.	Oxalidaceae	Indian sorrel	Amliti saga	H	L	Leaves are cooked with mustard oil, chilly, salt with potato as delicious curry to eat
64.	*Paederia foetida* L.	Rubiaceae	Skunk Vine	Pasaruni	H	L	Leaves are eaten after frying or roasting
65.	*Phyla nodiflora* (L.) Greene	Verbenaceae	Frog Fruit	Langli saga/ Kicharanga	H	L	Leaves are collected and taken after cooking
66.	*Pimpinella heyneana* (Wall. ex DC.) Kurz	Fabaceae	Heyne burnet	Charmali	H	L	Leaves along with flowers and seeds are collected, fried then eaten. The plant is having a special fragrance.
67.	*Pisum sativum* L.	Fabaceae	Pea	Matar saga	H	L	Leaves and young shoots are collected, fried with oil and other vegetables, eaten
68.	*Plectranthus mollis* (Aiton) Spreng.	Lamiaceae	Soft-Stem Mintleaf	Sakra/Gondri	H	L, Se	Leaves are fired with oil and chilly then eaten, also seeds are used to prepared sweets.

69.	*Polygonum plebeium* R.Br.	Polygonaceae	Alpine knot weed	Muthi saga	H	L	Leaves and young shoot are roasted with mustard oil and then eaten
70.	*Portulaca oleracea* L.	Portulacaceae	Common purslane	Balubalua saga	H	L	Tender leaves and shoots are collected, roasted then eaten
71.	*Raphanus sativus* L.	Brassicaceae	Radish	Mulasaga	H	L, Rt	Leaves are fried along with other vegetables then eaten and modified root is used as vegetable and in salad
72.	*Rivea hypocrateriformis* Choisy	Convolvulaceae	Midnapore Creeper	Kindu sag	C	L	Leaves are eaten after frying or roasting
73.	*Rungia pectinata* (L.) Nees	Acanthaceae	Comb Rungia	Hasa ada/Mati sag	H	L	Leaves are collected, fried with oil then eaten
74.	*Senna tora* (L) Roxb	Caesalpiniaceae	Sickle Senna	Chakunda Sag	H	L	Tender leaves and shoots are cooked and then taken as food
75.	*Solanum americanum* Mill.	Solanaceae	Black nightshade	Nununia	H	L	Leaves are collected fried, then eaten
76.	*Solanum tuberosum* L.	Solanaceae	Patato	Allu saga	H	L,Tu	Fresh leaves are collected, roasted with oil and then eaten and Tubers are boiled or fried and eaten
77.	*Spinacia oleracea* L.	Chenopodiaceae	Spinach	Palanga	H	L	Leaves are fried with vegetables and also cooked with dal and potato to make dalma curry.
78.	*Talinum portulacifolium* (Forssk.) Asch. ex Schweinf.	Talinaceae	Ceylon Spinach	Matipoi	H	L	Leaves are collected fried with other vegetable then eaten
79.	*Trachyspermum ammi* (L.) Sprague	Apiaceae	Indian dill	Juani	H	L	Leaves and young shoots are collected, roasted then eaten. It is highly scented
80.	*Trianthema portulacastrum* L	Aizoaceae	Horse-Purslane	Puruni saga	H	L	Leaves and young shoots are collected, fried then eaten
81.	*Trigonella corniculata* L.	Fabaceae	Cultivated Fenugreek	Firingi saga/Kasturimethi	H	L	Leaves are fried along with other vegetables
82.	*Trigonella foenum-graecum* L.	Fabaceae	Fenugreek	Methi	H	L	Fresh leaves are collected and chutney is prepared or roasted and taken
83.	*Vicia sativa* L.	Fabaceae	Garden vetch	Anisaga	H	L	Leaves are roasted with oil and then eaten
84.	*Aegle marmelos* (L.) Correa	Rutaceae	Bael apple	Bel	T	Fr	Ripe fruits is eaten raw or by cooking and often used to prepare juice/drink
85.	*Artocarpus heterophyllus* Lam.	Moraceae	Jack fruit	Panasa	T	Fr	Ripe fruits are sweet, eaten raw and the unripe fruits are used as vegetables
86.	*Averrhoa carambola* L.	Oxalidaceae	Star fruit	Karamanga	T	Fr	Eaten raw or cooked
87.	*Borassus flabellifer* L.	Araceae	Palmyra Palm	Tala	T	Fr	Fruits are having sweet, jelly sap, consumed as raw/drink
88.	*Coccinia grandis (L.) Voigt*	Cucurbitaceae	Lvy gourd	Kainchikakudi	C	Fr	Fruits are consumes raw or cooked
89.	*Cucumis melo* L.	Cucurbitaceae	Muskmelon	Phutikakudi	C	Fr	very popular summer fruit in northern parts of India
90.	*Dillenia indica* L.	Dilleniaceae	Elephant apple	Oau	T	Fr	Ripe fruits are sour in taste, used for flavouring curries and to prepare different sour dishes (pickles/jellies).
91.	*Dioscorea alata* L.	Dioscoreaceae	Asiatic yam	Khamb alu	C	Tu	Tuber Consumed after boiling or cooked with other vegetables
92.	*Dioscorea bulbifera* L.	Dioscoreaceae	Air yam	Pita kanda	C	Tu	Tubers are kept in water for a long time then boiled/cooked and eaten
93.	*Dioscorea pentaphyla* L.	Dioscoreaceae	Five Leaf Yam	Masia kanda	C	Tu	Tubers are eaten by cooking as vegetable
94.	*Dioscorea tomentosa* L.	Dioscoreaceae		Taraga kanda	C	Tu	Tubers are boiled, then cooked and eaten
95.	*Diospyros malabarica*	Ebenaceae	Gaub	Mankada kendu	T	Fr	Ripe fruits are soft, sweet in

	(Desr.) Kostel		persimmon				taste and eaten as raw
96.	*Diospyros melanoxylon* Roxb.	Ebenaceae	Coromandel Ebony persimmon	Kendu	T	Fr	Ripe fruits are sweet in taste and eaten as raw
97.	*Ficus benghalensis* L.	Moraceae	Banyan	Bara	T	Fr	Ripe fruits are eaten in food scarcity period. Tribal peoples use it as food regularly
98.	*Ficus recemosa* L.	Moraceae	Clister fig tree	Goolar	T	Fr	Ripe fruits are eaten as raw
99.	*Limonia acidissima* Groff	Rutaceae	Wood Apple	Kaintha	T	Fr	The pulp of ripe fruits are sour in taste and used to prepare chutney/jellies and often eaten as raw
100.	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Sapotaceae	Indian Butter Tree	Mahula	T	Fl	Flowers are edible, which is very delicious and nutritive and also used in the preparation of local wine
101.	*Manilkara hexandra* (Roxb.) Dubard	Sapotaceae	milk tree	Khirakoli	T	Fr	Ripe fruits are eaten fresh as berries
102.	*Momordica dioica* Roxb. ex Willd.	Cucurbitaceae	Spiny gourd	Kankada	C	Fr	Fruits are consumed as vegetable by frying with oil and other vegetables
103.	*Musa paradisiaca* L.	Musaceae	Banana	Kela	T	Fr, Fl, St,	Fruit is eaten, both in raw and ripen form. The flower of the plant is also consumed by removing the spathe followed by cooking, and the central stock is rich in iron and cooked in rural areas.
104.	*Nelumbo nucifera* Gaertn.	Nelumbonaceae	Lotus	Padma	H	Rt, Se	Root is collected, cut into small pieces then fried and eating. Seeds are eaten as raw or cooked
105.	*Nymphaea alba* L.	Nymphaeaceae	Water lily	Kain	H	St	Stem is collected, fried then eaten
106.	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Date palm	Khajuri	T	Fr	Ripe fruits are sweet, eaten raw and can be preserved to prepare jellies/jams etc.
107.	*Phyllanthus acidus (*L.) Skeels	Phyllanthaceae	Star Gooseberry	Nara koli	T	Fr	Fruits are consumed as raw or cooked. The mature fruits are also eaten fresh with salt to neutralize the acidity
108.	*Phyllanthus emblica* L.	Phyllanthaceae	Indian Gooseberry	Amla	T	Fr	Fruit is eaten raw as berries and used to prepare pickles/jellies
109.	*Pithecellobium dulce* (Roxb.) Benth.	Mimosaceae	Sweet Tamarind	Sima Kaian	T	Fr	Fruit is a pod with sweet, pulpy flesh that surrounds the seed, are edible as raw or by cooking
110.	*Syzygium cumini* (L.) Skeets	Myrtaceae	Java plum	Jamu	T	Fr	Ripe fruits are widely eaten as berries
111.	*Trapa natans* var. *bispinosa* (Roxb.) Makino	Lythraceae	Water Chestnut	Pani singada	H	Fr	The nuts are eaten raw when fresh of consumed after cooking or boiling.
112.	*Ziziphus oenoplia* (L.) Mill.	Rhamnaceae	Jackal jujube	Kanteikoli	S	Fr	Ripe fruits are eaten raw mostly by the children as it is sweet and acidic in taste.

T:Tree, S:Shrub, H:Herb, C:Climber, L:Leaf, Fl-:Flower, Fr:Fruit, Sh:Shoot, Tu:Tuber, Rt:Root, Se:Seed

Table-2. Selected plant species with their English name part(s) used and food value.

Sl. No	Name of the plant species	English name	Part (s) used	Food value(g/100g of dry wt. of tissue)		
				Carbohydrate	Protein	Fat
1	*Alternanthera sessilis* L.R.Br.	Sessile Joy weed	L/S	11.6	5.0	0.7
2	*Azadirachta indicia* A.Juss	Neem	L ,F		16.6	
3	*Bauhinia purpurea* L.	Geranium tree	L,S	6.82	15.2	4.15
4	*Brassica napus* L.	Rape	L, Se	4.9	2.7	0.2
5	*Brassica oleracea* L. Var capitata L.	Cabbage	L	6.8	3.4	0.2
6	*Centalla asiatica* L.	Indian pennywort	L	8.6	10.0	0.27
7	*Chenopodium album* L.	White goosefoot	L	7.3	4.2	0.80
8	*Cinnamomum tamala* (Buch	Indian cassia-lignea	L	74.97	7.61	8.36
9	*Cleome gynandra* L.	Spider flower	L	6.2	7.6	0.4
10	*Colocasia esculenta* (L.) Schott	Elephant ear taro	L, Tu	5.8	3.9	0.6
11	*Commelina benghalensis* L.	Day flower	L,St	4.69	3.98	0.64
12	*Corchorus capsularis* L.	White jute	L	12.4	5.6	0.28
13	*Enydra fluctuans* DC.	Water cress	L	6.1	1.6	0.2
14	*Glinus oppositifolius* (L.)A.DC.	Glinus	L , St	38.2	12.5	2.3
15	*Hibiscus sabdariffa* L.	Roselle	L	6.45	2.73	0.36
16	*Ipomoea aquatica* Forssk.	Swamp cabbage	L	3.14	1.6	0.2
17	*Marsilea minuta* L.	Dwarf Water Clover	L	2.3	1.53	0.002
18	*Momordica charantia* L.	Bitter gourd	L, Fr,Fl	3.70	1.00	0.17
19	*Moringa oleifera* Lam.	Drum stick	L.Fr, Fl	8.28	9.40	1.40
20	*Murraya koenigii* L. Spreng	Curry tree leaf	L	18.70	6.10	1.00
21	*Oxalis corniculata* L.	Indian sorrel	L	24.67	22.28	2.3
22	*Polygonum plebeium* R.Br	Alpine knot weed	L	12.5	14.9	1.24
23	*Portulaca oleracea* L	Common purslane	L	3.4	1.30	0.1
24	*Raphanus sativus* L.	Radish	L, Rt	10.6	4.4	0.2
25		Midnapore Creeper	L	57.63	19.27	2.66
26	*Trianthema portulacastrum c.Horse.purslane*	Ceylon Spinach	L ,S	30.2	24.6	1.69
27	*Trigonella foenum-graecum* L.	Fenugreek	L	12.6	5.2	0.6
28	*Dioscorea pentaphyla* L.	Five Leaf Yam	Tu	40.5	3.12	
29	*Ficus benghalensis* L.	Banyan	Fr	19.18	0.75	0.30
30	*Ficus recemosa* L	Clister fig tree	Fr	15.84	28.12	1.0
31	*Momordica dioica* Roxb. ex Willd.	Spiny gourd	Fr	7.7	3.1	3.0
32	*Phyllanthus emblica* L. Mill	Indian Gooseberry	Fr	10.18	0.88	0.58
33	*Ziziphus oenoplia*	Jackal jujube	Fr	20.53	1.2	0.20

L= Leaf. S= Shoot, F= Flower, Fr.= Fruit, Rt= Root, Tu= Tuber

Table-3. Selected plant species with their English name, plant part(s) used and nutrients present.

Sl.No	Name of the Plant species	English Name	Part (s) used	Nutrient(s) present (mg/100g dry wt. of tissue)						
				Ca	Mg	Fe	Mn	Na	P	Vitamin(s)
1	*Alternanthera sessilis* L.R.Br.	Sessile Joyweed	L,s	510		16.7			60	
2	*Azadirachta indicia* A.Juss	Neem	L, F	18.3	3.1				2.5	C
3	*Bauhinia purpurea* L.	Geranium tree	L, S	240		21.7				C
4	*Brassica napus* L.	Rape	L,S	49	14				21	A,C
5	*Brassica oleracea* L. Var capitata L.	Cabbage	L	40	10	0.47	12		26	A,B,C
6	*Centella asiatica* L.	Indian pennywort	L	453	0.56	682	309	34	1.2	B,C
7	*Chenopodium album* L.	White goosefoot	L	309	34	1.2	0.782			B,C
8	*Cinnamomum tamala.* Buch	Indian cassia-lignea	L	834	120	43				B,C (Cu,Zn)
9	*Cleome gynandra* L.	Spider flower	L	746		32			69	B,C
10	*Colocasia esculenta* (L.) Schott	Elephant ear taro	L,St	125	29	1.7			39.2	A,C
11	*Commelina benghalensis* L.	Day flower	L	1431	221				192	B,C,K
12	*Corchorus capsularis* L.	White jute	L	366	11.6			12	122	B,C,K
13	*Enydra fluctuans* DC.	Water cress	L	902	57	23		35		B,C
14	*Glinus oppositifolius* (L.)A.DC.	Glinus	L, St	1693		22.1				B,C(Zn)
15	*Hibiscus sabdariffa* L.	Roselle	L	123	29	0.54				B,C
16	*Ipomoea aquatica* Forssk.	Swamp cabbage	L	77	71	1.67	0.16			A,B,C
17	*Marsilea minuta* L.	Dwarf Water Clover	L	110	136	5.07				B,C
18	*Momordica charantia* L.	Bitter gourd	L, Fr	19	17	0.43				A,B,C
19	*Moringa oleifera* Lam.	Drum stick	L.Fr, Fl	185	147	4.0	0.36		337	B,C
20	*Murraya koenigii* L. Spreng	Curry tree leaf	L	830	44	0.93			57	A,B,C
21	*Oxalis corniculata* L.	Indian sorrel	L	2.5	0.25			1.12	2.17	C
22	*Polygonum plebeium* R.Br	Alpine knot weed	L	27.4	17.73				10.13	C
23	*Portulaca oleracea* L	Common purslane	L	65	1.99				44	B,C
24	*Raphanus sativus* L.	Radish	L,Rt	210	22			42	400	A,B,C
25	*Rivea hypocrateriformis* Choisy	Midnapore Creeper	L	0.99	0.34				0.32	
26	*Trianthema portulacastrum C. Horse.purslanef*	Ceylon Spinach	L	12.6	0.654	86.3		44.8		A,B
27	*Trigonella foenum-graecum* L.	Fenugreek	L, S	176	191	33.5	1.228			A,B,C
28	*Dioscorea pentaphyla* L.	Five Leaf Yam	R	18	22	0.39			12	B,C,E
29	*Ficus benghalensis* L.	Banyan	Fr	35		0.37	0.128			B,C,E (K)
30	*Ficus recemosa* L	Clister fig tree	Fr	30.5		315		329	103	A,C
31	*Momordica dioica* Roxb. ex Willd.	Spiny gourd	Fr	75		0.87			18.8	A,B,C
32	*Phyllanthus emblica* L	Indian Gooseberry	Fr	25	10	0.31	0.144		27	B,C
33	*Ziziphus oenoplia L. Mill*	Jackal jujube	Fr	21	10	0.48	0.084		23	B,C, Zn

L= Leaf. S= Shoot, F= Flower, Fr.= Fruit, Rt= Root, Tu= Tuber