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Food and nutritional security through edible leafy wild vegetables constituting the food environment of tribal and other forest dwellers in the Jharkhand State of India

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Abstract

Jharkhand State of India is one of the most biodiversity rich regions of India having three different agro-climatic sub zones and more than 30% area covered under forests. Due to these diverse physiographic and climate conditions, biodiversity plays a significant role in providing food and nutritional security to the local tribal and other communities. The forest area is very rich in the availability of wild leafy vegetables. These edible leafy vegetable, most of those come as seasonal weeds, are the chief source of food and nutrition to the local inhabitants as well as for the fringe villages of the forests. The edible leafy weeds are not only available in the forest area but also these are available in plenty on marshy border habitat of ponds, watersides of crop fields, its border areas, waste land, and cultivated land. The present study was undertaken to explore the natural food environment of the Jharkhand, having several tribal communities, specifically with respect to seasonal availability, use, and traditional knowledge of wild leafy indigenous foods. The diversity of wild leafy vegetables found in Jharkhand covers 105 species of 77 genera and 48 families.

Keywords: Food security, wild Leafy vegetable, traditional knowledge, nutrition

Introduction

In general, plants provide 65% of the global requirement of edible protein ^[1] and in particular about 80% of the protein consumed by the humanity in developing countries comes from plants ^[2]. Traditional wild leafy vegetables are of great value for many different reasons. These wild vegetables have a great cultural importance, they are very well adapted to the environment in which they grow by their own and they have significantly high nutritional value being richer in protein, iron and other minerals and vitamins in respect to the cultivated vegetable varieties commonly eaten by the locals ^[3, 4, 5, 6]. Despite these advantages, most traditional plant foods are generally uncultivated and underutilized ^[7, 8]. Fast changing social and economical scenario, has led to erosion of traditional knowledge ^[9, 10]. Wild leafy vegetables are largely ignored in land use planning and implementation, economic development, and biodiversity conservation. Moreover, WLV-related traditional knowledge is rapidly eroding. With the advent of several developmental activities around tribal areas which are, after all, not related to their welfare, the tribal people are losing their traditional identity resulting in a good deal of loss of such treasure house of knowledge on plant genetic resources ^[11]. Therefore, this study is designed to fulfil a part of the knowledge gap by providing data on diversity, traditional knowledge regarding seasonal abundance, economic potential, and conservation value of WLV from Jharkhand state of India.

Material & Methods

Study Area

The study area of Jharkhand State lies between latitude 22°00' and 24°37' N and longitude 83°15' and 87°01' E. It has an area of 79,714 km² which constitutes 2.42% of the geographical area of India with 24 districts (Fig 1), whereas the population of the state is 32.98

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million (Census, 2011) which constitutes 2.72% of the country's population. Jharkhand being a newly formed state (28th) of India is characterized by thirty different tribes

inhabiting the region and accounting for 27.66% of total population with the recorded forest area of the state 29.61% of its geographical area.

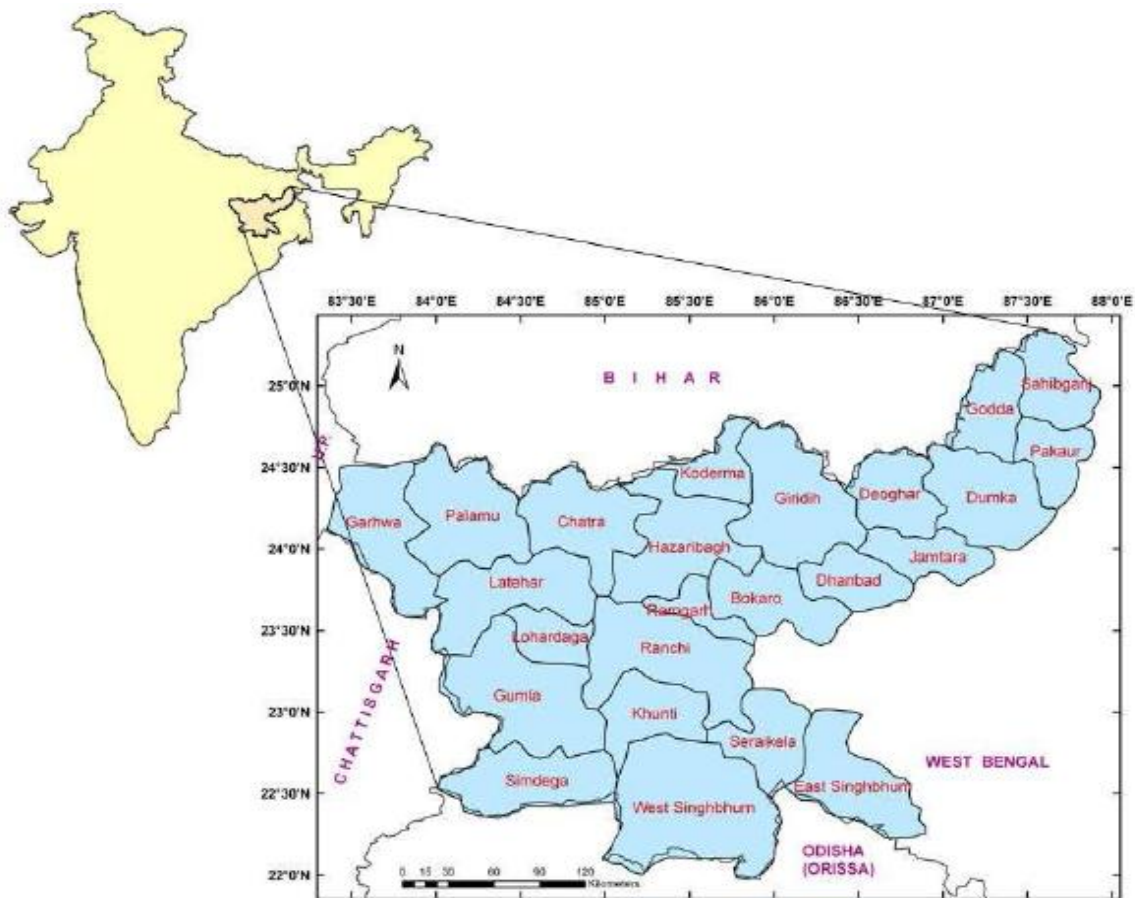


Fig 1: Map of Study of Area

The study was conducted in all the 24 districts of Jharkhand state covering 5 forest fringe villages in each district. In each village, 5 families were randomly selected from different tribal groups including at least one family from local community other than tribal.

Inventory of Wild edible leafy vegetable plant

Data were collected through a combination of tools and techniques of questionnaire, PRA, focused group interviews, discussions and available literatures. The purpose was explained and interviews were taken. To determine the authenticity of information collected during field work, repeated verification of data from different informants and in different areas at different times was done. Thus, only the specific and reliable information cross checked with many informants have been incorporated in the study.

The availability of wild edible leaves extend throughout the year for one or other species; therefore a time to time visit to one major local market where the leaves are sold was also done so that seasonal availability and their quantum can be assessed. Data were collected about the habits and habitats of the plants, method of the collection of edible leaves, method of consumption and storage of such leaves, and also about their method of use.

Authentication of Edible Leafy vegetable weed plants data

The diversified wild edible leafy vegetable plant species information is compared identified and cross verified with

herbarium specimens of Jharkhand and State floras. The local/regional names were collected from tribal and rural people and names were also compared from available literature.

Results

The list of wild edible leafy vegetable plant species with botanical name, family, plant parts used and mode of consumption of 105 wild edible leafy vegetable plant species belonging to 77 genera and 48 families are arranged in alphabetical order (Table No.1). Family wise number of wild leafy vegetables has been depicted through Radar diagram in Figure 2. The plants enlisted belong to 48 families. Out of 48 families, Amaranthaceae has maximum 10 plant species, Polygonaceae with 6, Asteraceae and Scrophulariaceae each with 5 plant species and Fabaceae with 4 plant species which are eaten as leafy vegetables.

Their growth habit includes tree, herb, shrub, and climber. Herbaceous plants make up the highest proportion of edible plants with 80 species (76.19 %), followed by trees with 12 species (11.43 %), climbers with 10 species (9.52%) and shrub with 3 species (2.86%). A large variety of such edible plants are also sold in the market as a means of livelihood for the rural population. Composition of wild leafy vegetables in Jharkhand is given in Fig 3.

Table 1: List of Wild Leafy Plants of Jharkhand

S. N.	Botanical Name	Family	Vernacular names	Part consumed	Habit & Habitat	Season of availability	Method of consumption
1	<i>Achyranthus aspera</i> L.	Amaranthaceae	Chirchita (Oraon) Chirchita (Santhal) Chirchita (Munda)	Leaves	Herb, Weed, Found in waste fields	August to February	Fresh leaves together with other spinach greens are cooked and eaten.
2	<i>Aerva lanata</i> Juss.	Amaranthaceae	Lopong Sag(Santhal) Lendra arxa (Oraon) Lupu aa (Ho)	Leaves	Herb, Weed found in waste land.	Rainy & Winter	Fresh Leaves are cooked and eaten.
3	<i>Alternanthera philoxiroides</i>	Amaranthaceae	Sanchi (Oraon) Gundark (Santhal) Salanti (Bhumiz)	Young Plant	Herb, Weed, Found in wet places, waste & cultivated fields	July to January	Fried/Roasted then eaten.
4	<i>Alternanthera sessilis</i> Br.	Amaranthaceae	Sanchi (Oraon) Gundarak (Santhal) Salanti (Bhumiz)	Young Plant	Herb, Weed, Found in wet places, waste & cultivated fields	July to January	Fried/Roasted then eaten.
5	<i>A. bilitum</i> Linn.	Amaranthaceae	Ach par aa/Leper aa (Ho) Ach par ara (Mundari)	Leaf and tender shoot	Herb, Weed, Found in waste places, Cultivated & non-cultivated fields.	Rainy and Winter	Young leaves and shoots are chopped into small pieces and fried in vegetable oil with tomato. Salt is added to taste.
6	<i>Amaranthus gangeticus</i> Roxb.	Amaranthaceae	Lal Sag (Oraon)	Leaves	Annual Herb, Found on cultivated land, Waste land, cultivated also.	April to June	Fresh leaves are cooked as spinach and have mild flavor.
7	<i>Amaranthus spinosus</i> Linn.	Amaranthaceae	Ach charaka (Oraon) Kanteli Chaulai (Santhal) Ach par ara (Mundari)	Leaf and tender shoot	Herb, Weed, Found in waste places.	Whole Year	Leaves and young shoots are cut into small pieces, cooked with salt and chilly and then eaten.
8	<i>Amaranthus viridis</i> Linn.	Amaranthaceae	Bhaji Sag (Oraon) Lotia Sag (Santhal) Marshi (Bhumiz, Gond)	Leaf and tender shoot	Herb, Weed, Found in cultivated grounds.	Whole Year	Leaves and young shoots are cut into small pieces, cooked with salt and chilly and then eaten.
9	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicolson	Araceae	Oal (Oraon & santhal) Elephant foot yam	Tender Leaves & corm	Herb, found on waste places.	Before the rains and rainy season	Young leaves Cooked as vegetable. Young leaves are fried with Besan in vegetable oil.
10	<i>Anethum graveolens</i> Linn.	Apiaceae	Soya (Oraon) Sowa (santhal)	Leaves	Herb, found on waste ground, Cultivated and non-cultivated fields.	Winter season	Fresh or dried leaves are used for boiled or fried meats and fish, in sandwiches and fish sauces.
11	<i>Antidesma diandrum</i> Roxb.	Euphorbiaceae	Kundui (Oraon) Matha arak (santhal) Mata ara (Munda)	Leaves	Shrub to tree, Weed, found near streams.	Rainy season	Young leaves are used in curry and as vegetable.
12	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem	Leaves	Tree, Common around villages	March - April	New leaves are preferred. Cooked as vegetable.
13	<i>Bacopa monnieri</i> Linn.	Scrophulariaceae	Brahmi Sag	Leaves	Herb, Wet lands	Rainy & winter season	Leaves are cooked as vegetable.
14	<i>Basella alba</i> Linn.	Basellaceae	Poi sag (Oraon) Poi Sag(Munda)	Leaves	Climber, Moist places	Rainy & Winter season	Stem and leaves are used to prepare curry.
15	<i>Basella alba var. rubra</i>	Basellaceae	Poi sag (Oraon), Poi Sag(Munda)	Leaves	climber, Weed, often cultivated	Rainy & Winter season	Stem and leaves are used to prepare curry.
16	<i>Bauhinia purpurea</i> L.	Caesalpiniaceae	Komaraca (Oraon) Singarak (Santhal) Singara (Mundari)	Leaves	Tree, Forests	Rainy season	Young shoots along with leaves are collected, cooked as curry or fried and taken
17	<i>Bauhinia retusa</i> Roxb.	Caesalpiniaceae	Teor (Oraon) Teor (Santhal) Laba (Munda)	Leaves	Tree, Forests	Rainy season	Young shoots along with leaves are collected, cooked as curry or fried and taken
18	<i>Bidens pilosa</i> Linn.	Asteraceae	Maina Sag (Munda), Mayna arxa (Oraon)	Leaves	Herb, Waste land, moist forests and also in plains	Rainy season	Shoots, tips and young leaves are good potherbs. Its dry leaves are also kept for use and flavour. Cooked as vegetable.
19	<i>Bigonia picta</i> Sm.	Bigoniaceae	Pakhanachatta(Oraon) Pakhanachatta(Santhal) Lundi Ara (Munda)	Leaves	Herb, Weed, found on wet land.	Aug. to Nov.	Leaves are collected, cooked as curry and taken.
20	<i>Boerhaavia diffusa</i> Linn.	Nyctaginaceae	Khapra arxa (Oraon) Khapra sag (Santhal) Kecho Ara (Mundari)	Fresh Whole Plant	Herb, Weed, Found in grassy waste grounds.	August to December	Tender leaves and young shoots are collected, fried/ roasted then eaten.
21	<i>Brassica juncea</i> L.	Brassicaceae	Indian mustard	Whole plant	Herb, Weed, Found in grassy waste grounds.	Winter season	Cooked as Vegetable
22	<i>Bryonopsis laciniosa</i>	Cucurbitaceae	Toktoyan Sag (Oraon) Toktoyan	Tender leaves	Perrenial climber, found on waste	Whole Year	Leaves cooked as vegetable.

	L.		(Santhal)	and shoots	ground		
23	<i>Butomopsis latifolia</i> (D. Don) Kunth	Alismataceae	Lundi ara (Munda)	Leaves	Annual Herb, Weed, Aquatic & Marshy	Whole Year	Boiled then water is squeezed out and then cooked as pot herb.
24	<i>Cassia occidentalis</i> L.	Caesalpiniaceae	Koha Chakonda (Oraon) Barka Chakonda (Santhal) Murang Chakonda (Munda)	Leaves	Herb, Weed, Found in waste places.	March to May	Tender leaves are cooked and eaten.
25	<i>Cassia tora</i> L.	Caesalpiniaceae	Chekor (Oraon) Chakora (Santhal)	Leaves & Seeds	Herb, Weed, Found in waste grounds.	Rainy season	Leaves are cooked and eaten as vegetable.
26	<i>Catharanthus pusillus</i> Murr.	Apocynaceae	Marchi Sag (Santhal), Maricha arxa (Oraon)	Leaves	Herb, Waste land, cultivated land	Rainy season	Very tender leaves are cooked as vegetable.
27	<i>Celosia argentea</i> L.	Amaranthaceae	Kim Araxa (Oraon) Siliari (Santhal) Sirgiti Ara (Munda)	Leaves	Herb, Weed, found on agricultural fields.	August to January	Young leaves and shoots are collected, roasted then eaten.
28	<i>Centella asiatica</i> Linn.	Umbelliferae	Mukha Arka (Oraon) Chauke Ara (Munda) Beng sag	Whole Plant	Herb, Weed, Found in wet places throughout the year	Whole year, mainly in rains and spring.	Leaves and young shoots are collected, roasted then eaten.
29	<i>Chenopodium album</i> Linn.	Chenopodiaceae	Bhathua arak (Santhal)	Leaves	Herb, Weed along with Rabi crops.	Rainy season	Leaves and young shoots are fried/ roasted then eaten.
30	<i>Cissus adnata</i> Roxb.	Vitaceae	Khatta Sag (Oraon) Jojo ara (Munda)	Leaves	Creepers, climbing shrub Weeds (Moist Forest)	Whole year	Leaves cooked as vegetable.
31	<i>Cleome gynandra</i> L.	Capparidaceae	Sad Hurhuria Sag (Santhal) Charmani aa (Ho), charmani (Munda)	Leaves	Herb, Weed, found in waste grounds.	July to February	Leaves and young shoots are collected, roasted then eaten.
32	<i>Cleome monophylla</i> L.	Capparidaceae	Tota sirio (Oraon) Hurhuria Sag (Santhal), Hurhuria aa (Ho)	Leaves	Herb, Weed, found in waste grounds.	July to November	Leaves and young shoots are collected, roasted then eaten.
33	<i>Cleome viscosa</i> Linn.	Capparidaceae	Sirioarkho (Oraon) Namkani (Santhal)	Young Plant	Herb, Weed, Found in cultivated & uncultivated fields	May to October	Leaves and young shoots are collected, fried/ roasted then eaten.
34	<i>Coccinia grandis</i> L.	Cucurbitaceae	Kundari (Santhal & Mundari), Van Kundri (Ho)	Leaves and leafy shoots	Weed, climber found on waste lands.	Whole year.	Leaves and leafy shoots are collected, cut into small pieces, cooked with salt and chilly and then eaten.
35	<i>Colocasia antiquorum</i> Linn.	Araceae	Pechki (Oraon)	Leaves	Perennial herb, Weed, found in wet lands	June to November	Young tender leaves and leafy shoots are collected, cut into small piece, cooked with salt and chilly then eaten.
36	<i>Colocasia esculenta</i> L.	Araceae	Pechki Sag, Pechki arxa	Leaves	Herb, Weed, found in wet lands, Forests	Rainy	Young tender leaves and leafy shoots are collected, cut into small piece, cooked with salt and chilly then eaten.
37	<i>Commelina benghalensis</i> Linn.	Commelinaceae	Kenna Sag (Oraon) Kenna Sag (Munda) Upunda aa (Ho)	Leaves	Herb, Weed, common in Kharib season, Found in cultivated & uncultivated fields	September to January	Leaves and young shoots are collected, fried/ roasted then eaten.
38	<i>Corchorus capsularis</i> Linn.	Tiliaceae	Pat Sag (Oraon), Chench Koha (Munda) Pat sag (Santhal)	Leaves	Herb, Moist waste land	May to November	Tender Leaves and young shoots are collected, cooked then eaten. Usually it is lightly sauteed and eaten along with rice or rice gruel.
39	<i>Corchorus olitorius</i> L.	Tiliaceae	Koha Chanch (Oraon) Pat Sag (Munda)	Leaves	Herb, Weed, also Cultivated	June to November	Tender Leaves and young shoots are collected, cooked then eaten.
40	<i>Cordia dichotoma</i> Forst.	Boraginaceae	Dhanul (Oraon) Buch (Santhal) Bunch (Munda)	Leaves	Tree Forests	March to April	Tender leaves are cooked and eaten.
41	<i>Cyanotis axillaris</i> Roem.	Commelaceae	Tena arxa (Oraon)	Leaves	Herb, Wet grounds, rice fields.	Rainy season.	Cooked as vegetable.
42	<i>Cyphostemma auriculatum</i> Roxb.	Vitaceae	Lawai arxa (Oraon) Amad samad (Ho)	Tender leaves & shoots	Scandent shrub, Large climber. Evergreen Forests	Rainy & winter.	Tender leaves and shoots are cooked and taken as food
43	<i>Digera alternifolia</i> (L.) Aschers.	Amaranthaceae	Kari Bhanji (Oraon), Kari Gendhari (Santhal)	Tender leaves & shoots	Herb Grows wild in waste land.	Rainy season	Young plants are cooked and eaten as vegetable.
44	<i>Diplazium esculentum</i> Retz.	Athyrioideae	Kukri Sag., Injo arxa Lindung Bindung aa (Ho) Dhenki Sag	Leaves	Fern, Open marshy area, stream bank	May to July	Young and immature leaves are cooked as vegetable. It is eaten either after boiling or frying.

45	<i>Dryopteris cochleata</i> Don.	Dryopteridaceae	Kukri Sag, Kukri arxa Lindung Bindung aa (Ho)	Leaves	Fern, Grassland, Forest	March to May	Young and immature leaves are cooked as vegetable. It is eaten either after boiling or frying.
46	<i>Eclipta prostrata</i> L.	Asteraceae	Bring hraaj	Leaves	Annual herb, Moist places on waste ground.	Rainy season to early winter	Cooked as vegetable.
47	<i>Euphobia hirta</i> L.	Euphorbiaceae	Dudhia (Oraon) Dudhia (Santhal) Marang Dudhi (Munda)	Leaves	Herb, Weed, Found on waste land and forest	Most part of the Year.	It is a famine food. Tender leaves are cooked and eaten.
48	<i>Enhydra fluctuans</i> Lour.	Asteraceae	Muchri ara (munda)	Leaves	A trailing marshy perennial herb	April to June.	It is washed, chopped Cooked/Steamed and eaten.
49	<i>Eryngium foetidum</i> L.	Apiaceae	Kanta Dhania, Accho Dhania	Leaves	Herb, Waste land	Rainy & Winter season.	The leaves are used fresh as a culinary herb which has a similar, but stronger flavor than Coriander (<i>Coriandrum sativum</i>).
50	<i>Fagopyrum esculentum</i> Moench	polygonaceae	Ugal sag	Leaves	Annual Herb, Found on waste ground	Summer months.	Eaten raw or cooked as vegetable.
51	<i>Ficus geniculata</i> Kurz	Moraceae	Putkal (Oraon) Putkal (Santhal) hesa Jait putkal (Munda)	Leaves	Tree Found in forest	March to April	Young leaves and buds are cooked and eaten. Pickle is also made.
52	<i>Ficus infectoria</i> Roxb.	Moraceae	Phutkal (Oraon) Phutkal (Santhal) hesa Hesa putkal (Munda)	Leaves	Tree Found in forest	March to April	Young leaves and buds are cooked and eaten. Pickle is also made.
53	<i>Gamochaeta pensylvanica</i> Willd.	Asteraceae	Putam aa (Ho), Chitra sag, Ledra Sag	Leaves & tender shoots	Annual herb, Forests, Moist waste land	Rainy season.	Tender shoots with leaves are cooked and eaten as vegetable.
54	<i>Glinus lotoides</i> L.	Molluginaceae	Punernova, Dusera sag	Leaves & tender shoots	Annual prostrate herb, Forests	March to October.	Cooked as Vegetable. Young shoots and leaves are collected, roasted and then eaten.
55	<i>Glinus oppositifolius</i> L.	Molluginaceae	Gima	Leaves & tender shoots	Annual prostrate or creeping herb, Forests	March to October.	Slightly bitter in taste. Cooked as Vegetable. Young shoots and leaves are collected, roasted and then eaten.
56	<i>Hedyotis scandens</i> Roxb.	Rubiaceae		Leaves	Perennial climbing shrub. Forests in moist soil.	Whole Year.	Cooked as vegetable.
57	<i>Hibiscus sidariffa</i> Linn.	Malvaceae	Kudrum	Leaves & tender shoots	Annual or Perennial shrub Disturbed grounds	Whole Year	Tender leaves and stem cooked as vegetable.
58	<i>Hygrophila auriculata</i> (Schum.) Hiene	Acanthaceae	Koila ara (munda)	Leaves	A stout aquatic perennial herb	October to February	It is washed, chopped Cooked/Steamed and eaten.
59	<i>Ipomoea aquatic</i> Forssk.	Convolvulaceae	Kalmi (Oraon)	Leaves	Herb Weed, Common in water bodies, floating on mud or trailing in water.	Whole Year	Leaves and tender shoots are collected, cooked and then eaten.
60	<i>Jussiaea repens</i> Linn.	Onagraceae	Machli Sag, Nalkim arxa	Leaves	Herb, Wet lands	Rainy season.	Tender leaves with shoot cooked as vegetable.
61	<i>Jussiaea suffruticosa</i>	Onagraceae	Machli Sag, Nalkim arxa	Leaves	Herb, Wet lands	Rainy season.	Tender leaves with shoot cooked as vegetable.
62	<i>Lasia spinosa</i> L.	Araceae	Kantasaru	Tender leaves and stalk	Monocot weed, Perennial River bank, ditches and moist places.	October to February	Peeled leaf stalked after removing the spines and tender leaves are eaten as vegetables.
63	<i>Lepisanthes rubiginosa</i> Roxb.	Sapindaceae	Jal Kusum	Leaves	Tree, found in forests, riverside, road side etc.	Spring season.	Young leaves are cooked and eaten as vegetable.
64	<i>Leucas aspera</i> Spreng.	Labiatae	Guma (Chero & Kharwar)	Tender Young Plant	Herb, Annual Weed of Rabi season found in cultivated fields of Wheat, maize & Arhar crops	July to January.	Leaves and young shoots are roasted and taken as food.
65	<i>Leucas cephalotes</i> Spreng.	Labiatae	Choti Guma (Chero & Kharwar)	Tender Young Plant	Herb, Annual Weed of Rabi season found in cultivated fields of Wheat, maize & Arhar crops	Rainy season.	Leaves and young shoots are roasted and taken as food.
66	<i>Limnophila aromatica</i> (Lam.) Merr.	Scrophulariaceae	Lasodh Ara(Munda)	Tender leaves and shoots	Weed, aquatic & Marshy	September to February.	Cooked/Steamed and eaten. Chatni is also prepared.
67	<i>Limnophila confirta</i> Benth.	Scrophulariaceae	Muchari (Oraon) Hemcha Sag (Santhal)	Tender Leaves and shoots	Herb, Weed found in watery places and rice fields.	September to February.	Leaves and young shoots are roasted and taken as food.
68	<i>Limnophila gratioides</i>	Scrophulariaceae	Lasodh Ara (Munda) Kado sag, Chatter sag	Tender leaves and shoots	Perennial Herb, Weed, aquatic & Marshy	Rainy & Winter season.	Rainy & Winter season. Cooked/Steamed and eaten. Chatni is also prepared.
69	<i>Limnophila rugosa</i>	Scrophulariaceae	Lasodh Ara (Munda)	Tender leaves	Perennial Herb, Weed, aquatic &	Whole Year.	Cooked/Steamed and eaten. Chatni is also prepared Have essence of

	Roth.(Merr.)	e		and shoots	Marshy		unripe mango. It is eaten as condiment raw or cooked.
70	<i>Lobelia alsinoides</i> Lam.	Campanulaceae	Bari Ara (Munda)	Tender leaves and shoots	Herb, Weed, aquatic & Marshy	Oct. to Feb.	Cooked/Steamed and eaten, often cooked in curry.
71	<i>Marsilia minuta</i> L.	Marsiliaceae	Susuni (Oraon) Sunsunia (Santhal)	leaves	Herb, Perrenial fern, Found in wet places	Nov. to March.	Tender leaves and young shoots are roasted and taken as food.
72	<i>Marsilia quadrifida</i> L.	Marsiliaceae	Susuni (Oraon) Sunsunia (Santhal)	leaves	Herb, Perrenial fern, Found in wet places	Rainy & winter.	Tender leaves and young shoots are roasted and taken as food.
73	<i>Medicago lupulina</i> Linn.	Fabaceae	Neetho sag, Bindo sag	Leaves	Herb, found in lawns, gardens, waste areas, road side etc.	Winter.	Leaves are taken as vegetable.
74	<i>Medicago polymorpha</i> Linn.	Fabaceae	Neetho sag, Bindo sag	Leaves	Annual herb, found in lawns, gardens, waste areas, road side etc.	Winter.	Leaves are taken as vegetable.
75	<i>Mentha sativa</i> Linn.	Lamiaceae	Pudina	Leaves	Herb, found in wet places.	Whole Year.	Whole Year. Leaves are used for flavour and chatni.
76	<i>Merremia macrocalyx</i> (Ruiz & Pav.) O'Donnel	Convolvulaceae	Oye Munda aa (Ho)	Leaves	Perrenial herb, climber. Forests	Rainy season.	Young leaves and shoots are chopped into small pieces and fried in vegetable oil with tomato. Salt is added to taste.
77	<i>Melochia corchorifolia</i> Linn.	Sterculiaceae	Susuni (Oraon) Thuiak (Santhal)	Leaves	Shrub, Found in wet places	Rainy season.	Leaves are cooked and eaten
78	<i>Monochoria vaginalis</i> (Burm. F.) C. Presl	Pontederiaceae	Sadom Loch kor Ara (Munda)	Leaves	Weed, aquatic & Marshy	April to September.	Cooked/Steamed and eaten.
79	<i>Moringa oleifera</i> Lam.	Moringaceae	Munga sag (Oraon) Munga sag (Munda)	Leaves	Tree Cultivated in Backyards	Jan. to June.	Leaves are eaten after frying or roasting. Liquid curry is prepared with fermented rice water and rice granules.
80	<i>Murraya koenigii</i> L.	Rutaceae	Curry Patta	Leaves	Shrub	Whole year.	Used as flavoring agent
81	<i>Oxal scandens</i> Roxb.	Oleaceae	Rimil Bilee aa, Rimil tundu aa (Ho), Bhada bhadalia (Oraon)	Leaves	Small tree, Open forests	March to December.	Leaves are collected, roasted and then eaten. The fresh young leaves are cooked as leafy vegetable and also chewed during mouth ulcer.
82	<i>Ophioglossum reticulatum</i> L.	Ophioglossaceae	Sugga Sag	Leaves	Fern, on exposed sandy soil in wet places.	August to January.	Young fronds are commonly eaten as a salad or vegetable.
83	<i>Oxalis corniculata</i> Linn.	Oxilidaceae	Netho Sag (Oraon) Tandhi Chatom arak (Santhal)	Leaves	Herb, Weed, Found in Gardens	August to December.	Leaves are plucked, fried and taken.
84	<i>Oxalis corymbosa</i> Linn.	Oxilidaceae	Netho Sag (Oraon) Tandhi Chatom arak (Santhal)	Leaves	Herb, Weed, Found in Gardens	Winter months.	Leaves are plucked, fried and taken.
85	<i>Oxalis latifolia</i> Linn.	Oxilidaceae	Netho Sag (Oraon) Tandhi Chatom arak (Santhal)	Leaves	Herb, Weed, Found in Gardens	August to December.	Leaves are plucked, fried and taken.
86	<i>Paederia scandens</i> (Lour.) Merr.	Rubiaceae	Gandal pata, Guli gandhari	Leaves	Twinning vine on hill side, stream side, forest and its edges.	Whole Year.	Cooked as Vegetables. Leaves are boiled and made into soup, the odour disappearing.
87	<i>Pergularia daemia</i> Forssk.	Asclepiadaceae	Mausi sag	Leaves	Perrenial twinning herb, found in hill sides, in forests along forest edges, stream sides, twinning on trees.	Rainy season.	Leaves are cooked and eaten as vegetable.
88	<i>Polygonum barbatum</i> L.	polygonaceae	Sake arxa (Oraon) Sake Sag (Santhal) Madara (Munda)	Leaves	Herb, Weed, found ion wet lands.	June to December.	Young plants are cooked and consumed.
89	<i>Polygonum glabrum</i> Willd.	polygonaceae	Sukripota (Munda) Sauri Arak (santhal)	Leaves	Herb, Weed, found near streams.	June to December.	Young plants are cooked and consumed.
90	<i>Polygonum plebejum</i> R.Br.	polygonaceae	Chimti Sag (Oraon) Mooze-ara (Munda)	Leaves	Herb, Weed common in Rabi season on waste ground & cultivated fields	Jan. to April.	Young plants are cooked and consumed.
91	<i>Portulaca oleracea</i> Linn.	Portulacaceae	Gol gala (Santhal)	Young Plant	Herb, Weed, common on waste open grounds	Whole Year, abundant in rainy season.	Tender leaves and shoots are collected, roasted then eaten.
92	<i>Portulaca quadrifida</i> Linn.	Portulacaceae	Gol gola sag, Noni sag	Leaves	Herb, Waste land	Whole Year.	Cooked as vegetable.
93	<i>Rumex dentatus</i> L.	polygonaceae	Tissa Palak arxa (oraon) Tissa	Leaves	Herb, Weed, found on waste places.	Rainy season.	Leaves are cooked and eaten.

			palak (Santhal)		Common in Rabi season.		
94	<i>Rumex vesicarius</i> L.	polygonaceae	Tissa Palak arxa (oraon) Tissa palak (Santhal)	Leaves	Herb, Weed, found on waste places.	May to July.	Leaves are cooked and eaten.
95	<i>Rungia parviflora</i> Nees.	Acanthaceae	Kawoa Sag (Oraon) Hasa-arak (Munda)	Young Plant	Herb, Weed, common on low land harvested rice fields	Whole Year.	Tender leaves and shoots are collected, cooked then eaten.
96	<i>Sagittaria sagittifolia</i> L.	Alismataceae	Luchkor (Munda)	Leaves	Weed, aquatic & Marshy	Whole year.	Boiled then water is squeezed out and then cooked as pot herb.
97	<i>Smilax ovalifolia</i> Roxb.	Smilacaceae	Ram ratan	Leaves	Large climber, common in forest areas, cultivated in gardens.	Whole Year.	Cooked as vegetable.
98	<i>Solena amplexicaulis</i> (Lam.) GANDHI	Cucurbitaceae	Van Kakri	Leaves	Perrenial climbing herb, found in forests & plains.	September to December.	Cooked as vegetable.
99	<i>Sphaeranthus hirtus</i> L.	Asteraceae	Tonka Pudina, Daun Pudina	Leaves	Annual herb highly scented. Weed of rice fields and moist places.	Rainy & Winter.	Tender shoots are cooked then taken as food.
100	<i>Spergula arvensis</i> Linn.	Caryophyllaceae	Kharika arxa	Leaves	Annual herb highly scented. Weed of rice fields and moist places.	November to february.	Leaves are collected, cooked and eaten.
101	<i>Trianthema decandra</i> Linn.	Aizoaceae	Purni (Munda)	Tender Young Plant	Herb, Weed, common with Kharif crops	July to December.	Leaves and young shoots are collected, fried then eaten.
102	<i>Trianthema monogyna</i> Linn.	Aizoaceae	Swet Punernova (Munda) Kecho	Tender Young Plant	Herb, Weed, common as a weed in wasteland, roadside, lawns, grdens, cultivated fields & paddy fields.	Rainy season.	Leaves and young shoots are collected, fried then eaten.
103	<i>Vangueria spinosa</i> roxb.	Rubiaceae	Sarla Kanta (Santhal) sarla achch (Munda)	Leaves	Shrub to small tree, Forests	May to July.	Leaves are cooked and eaten.
104	<i>Vicia hirsuta</i> Koch.	Papilionaceae	Origara (Oraon), Chirinji Sag	Leaves	Annual herb, common in cultivated land, fallow land, waste ground, flower beds, road sides, rocky meadows	Whole Year.	Tender leaves are eaten as vegetable.
105	<i>Vicia sativa</i> Linn.	Papilionaceae	Jhilo sag (Santhal), Jhilo arxa (Oraon)	Leaves	Annual climbing herb, common in cultivated land, fallow land, waste ground, flower beds, road sides, rocky meadows	Winter season.	Tender leaves are eaten as vegetable.

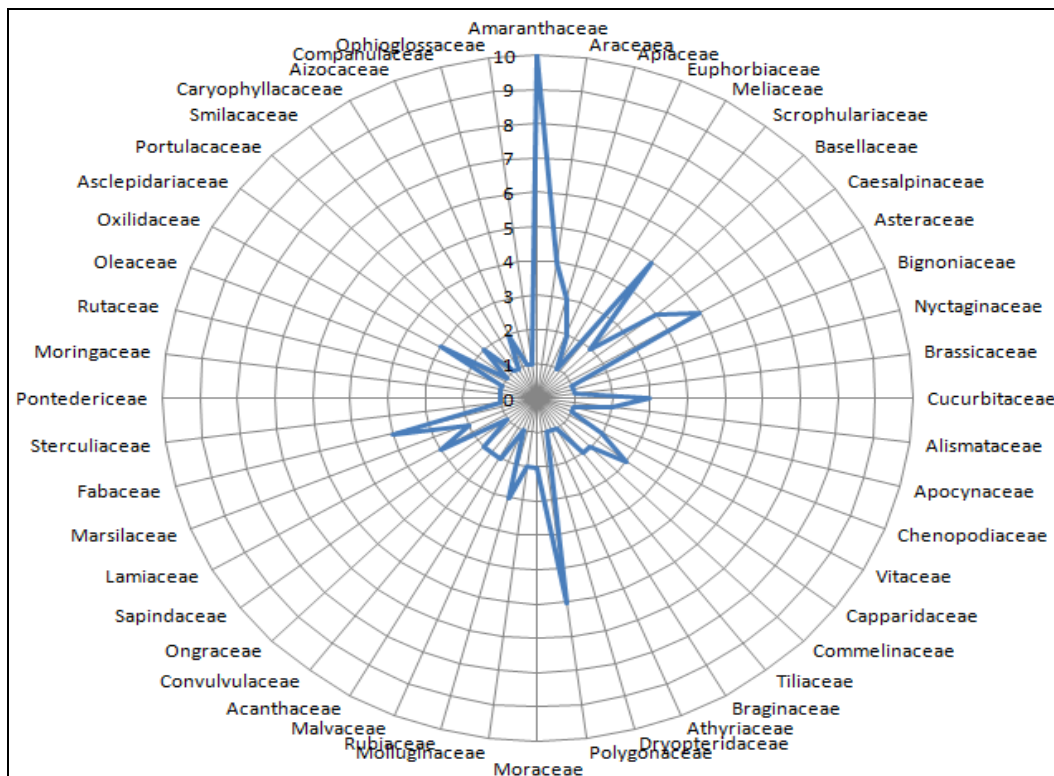


Fig 2: Radar Diagram of the Family & species of Wild Leafy vegetables

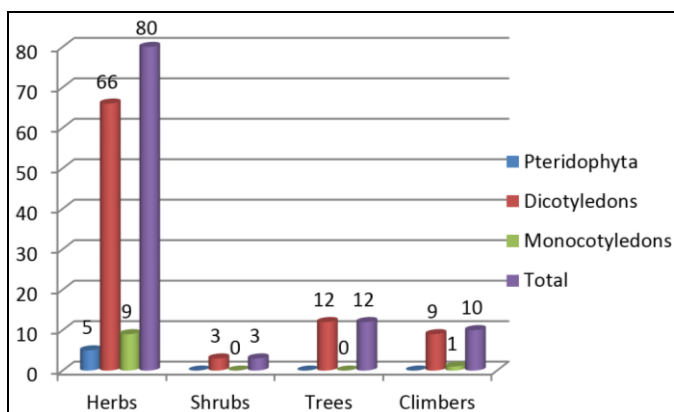


Fig 3: Composition of Wild Leafy Vegetable Plants of Jharkhand

The study also reveals that out of the 105 species, 90 species Dicots, 10 species Monocots and 5 species are Pteridophytes. Abstract of wild leafy vegetables is given in Fig 4.

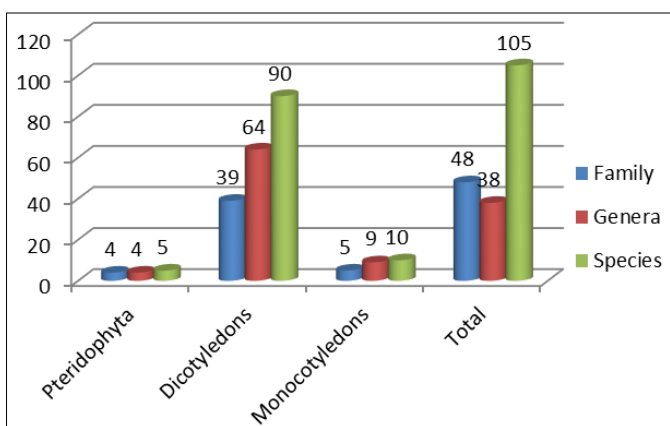


Fig 4: Abstract of Wild Leafy Vegetable Plants of Jharkhand

A large variety of such edible plants are also sold in the

market as a means of livelihood for the rural population. Many of these vegetables are dried and sold or stored for their off season use. This is called ‘Sukti’ in local market.

The ethnic communities have different modes of consumption of these wild leafy vegetables. Most of the vegetables are cooked before eating but their frequency of use varies from place to place and from one community to other depending upon the availability and preference in taste and food habit. Use of one or more vegetable is commonly part of the local meal.

The tender leaves of some tree species like *Tamarindus indica* (Imli) and *Schleichera trijuga* (Kusum) are used by the tribal and other forest communities as vegetables. Kusum leaves are dried and powdered to be used mixing with the rice water (Manr) for enhancing taste and flavour.

Discussion

From several generations, tribal and forest dweller are identifying the plants with their palatability and taste and the local name, which vary from place to place, has been assigned on the basis of their characters [12]. In the state of Jharkhand, agricultural practices do not provide sufficient food to local people and therefore they are primarily dependent on natural food resources [13]. The preference of food and food habits of the tribal and other communities inhabiting the forests depend very much on the availability of the wild leafy vegetables within the village and from the surrounding forests and hilly areas. The villagers consume these leafy vegetables as food but with the experience of generations, they developed the knowledge of medicinal value of such wild vegetables. These properties of leafy vegetables not only nourish them but also keep the tribal healthy and fit for hardworking labour throughout the day [14].

The ever growing population and increasing demand of resources are going to be a threat for the very survival of living beings in the days to come. Compilation of traditional knowledge of utilizing natural sources as nutritious and

healthy food without any significant cost will pave the way for their in-situ conservation through non-destructive harvesting and possibility of ex-situ low cost cultivation. Thus for alleviating hunger and malnutrition, indigenous wild leafy vegetables can play an important role in future. These are important sources of proteins, minerals, micronutrients and vitamins. These hitherto under - utilized vegetables can transform the nutrition and health scenario in the tribal state of Jharkhand if a planned approach is designed to enhance the production and consumption of these health-promoting leafy vegetables. In the backdrop of biotic pressure and subsequent increase in deforestation and environmental degradation, the change in landscape is inevitable in an economy in transition like India ^[15] and this is bound to present a challenge to the maintenance of livelihoods, agricultural and environmental biodiversity.

Conclusion

Local tribal and other forest dwelling communities in Jharkhand are highly dependent on the wild leafy vegetables for their food securities and nutritional needs. Besides, these medicines have great medicinal potential known to local people as traditional knowledge earned and transferred from one generation to another. The findings of present study validates that the wild leafy vegetables are closely linked with the poverty and socio-economic condition of the tribal and local communities in the entire state of Jharkhand for their day to day food requirements. These are the nature's gift to the inhabitants of forests to fulfil their nutrition requirements. These are also some source of earning for them as they collect these wild leaves and after meeting their requirements, sell them in the local markets.

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