



# Ethno Botany and Nutritional Status of Some Edible Plants of South Odisha, India

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*Abstract: The present paper reports ethno botanical use and nutrient analysis of 16 edible plants of South Odisha under 15 genera and 16 species. Various ethnic groups and rural people consume 12 wild species, 2 cultivated species and 2 species that are wild as well as cultivated. The taxa include 10 dicotyledonous species under 10 genera and 10 families while monocot includes 6 species under 5 genera and 5 families. The edible plant species include 9 herbs, 2 twiners and 5 tree species. Most of these plants are used by the tribal people at the time of food scarcity. Analysis of nutritive value such as crude protein, total sugar, total lipid, vitamin B1 and vitamin C content of edible plants revealed that leafy vegetable *Moringa oleifera* (6.6%) showed highest crude protein and highest total lipid (0.013mg g<sup>-1</sup>) content while tuber of *Dioscorea oppositifolia* (30.8%) showed highest total sugar content. Highest vitamin B1 is shown by leafy vegetable *Glinus oppositifolius* (0.0015 mg g<sup>-1</sup>). Fruit plant *Phyllanthus emblica* (5.16 mg g<sup>-1</sup>) showed highest vitamin C content. Some of these edible plants may be used as food security, economic growth as well as medicine that are required in small quantity to cure some of the diseases the tribal people suffer from. Suggestion has been made for improvement, conservation of these edible plants for future potential.*

*Keywords: Edible plants, ethnobotany, nutritive value, South Odisha*

## 1. Introduction

Wild food plants are categorised as underutilized or neglected crops that occurring in wild or are grown in local scale whose economic potential have been poorly addressed, confining it into mostly traditional and local use only. A considerable proportion of tribal population is still under-nourished and the people living in remote areas cannot produce enough food grains to meet the yearly requirement. Therefore, a large share of such population meets its food requirement through non-conventional means by consuming various wild plants and animal resources especially in periods of food scarcity (FAO, 2004; Balemie & Kebebew, 2006). The indigenous forest foods are of great cultural significance to rural/tribal population



in developing countries including India (Maikhuri et al., 2004; Kala, 2007; Misra et al., 2008; Rana et al., 2012). Wild food plants serve as alternative to staple food during periods of food deficit and are the valuable supplements for a nutritional balanced diet; one of the primary alternative source of income for many resource poor communities, and the source of species for domestication (Shrestha & Dhillon, 2006). Wild food contributes to diet diversity and hereby constituting an essential part of nutritionally poor diet (FAO, 2005). Wild fruits provide vitamins, flavourings and compounds of nutritional, gastronomic and social important such as alkaloids, essential oils and phenolics derived from secondary metabolism (FAO, 1999). Much work has been done on ethnobotany of wild edible plants world over (Abubakar et al., 2012; Ju et al., 2013; Kang et al., 2014). In India, much work has been carried out on ethnobotany of wild edible plants (Maheswari & Singh, 1984; Sankaram et al., 2006; Rashid et al., 2008; Deshmukh & Waghmode, 2011; Suresh et al., 2014). There are some reports on ethnobotany and traditional use of wild edible plants of Odisha (Girach et al., 1988; Girach & Aminuddin, 1992 ;). In India, nutritional evaluation of various types of edible fruit plants have been reported by various authors (Dahot, 1993; Nazarudeen, 2010; Deshmukh & Waghmode, 2011; Mahapatra et al., 2012; Anjum & Tripathi, 2013). Work on wild edible plants and their nutritional evaluation of Southern Odisha is meagre. In this study, an attempt has been made to collect ethnobotanical information on wild edible plants and their nutritional analysis in south Odisha.

## **2. Methods**

### **2.1 Study area**

Odisha state, in the eastern part of India, consists of 30 districts. Of these seven districts, viz., Ganjam, Gajapati, Rayagada, Koraput, Nawrangpur, Malkangiri and Kandhamal are in the southern part (collectively called as southern Odisha) with a diversified geographical status extending from coast to interior mountainous areas. This region constitutes a part of the Eastern Ghats of India. All these districts are covered with forest and inhabited by different ethnic groups, viz., Kondha, Koya, Paraja, Saura, Langia Saura, Bonda, Paika, Bhumia, Bhatra, Gond, Munda, Didayi, Gadaba, Juang and Kutia Kandha. Tribal and rural poor people collect wild plant products free from the environment especially from the forest and



consume them. Many of the wild forest products are consumed in normal time and some products during times of food scarcity.

## **2.2 Field survey and data collection**

For the survey, different places of southern Odisha were visited in different seasons during 2010-2014 and some of the elderly tribal and non-tribal men and women were identified and were interviewed to collect information on edible plants. A questionnaire was developed to collect information on Odia name of the plant, parts used, method of collection of plant parts, its availability and mode of food preparation. The data collected in this study is based on first-hand information. The referred plant specimens were collected in the company of at least one elderly man to make sure that the correct plant has been collected. The collected plant specimens were dried and herbarium specimens were prepared and deposited in the Herbarium of the P.G. Department of Botany, Berhampur University (BOTB), Berhampur. The specimens were identified with the help of the local floras (Saxena and Brahmam 1994-1996; Misra et al. 2009). The plants are enumerated alphabetically as per their botanical name along with family, Odia name (O), habit, ethno-botanical uses, consumption pattern, locality and fruiting period.

## **2.3 Sample preparation**

For the present study 16 plant specimens were selected for nutritional analysis of edible parts. The selected plants are *Alternanthera sessilis*, *Amorphophallus paeoniifolius*, *Caralluma adscendens*, *Colocasia esculenta*, *Commelina benghalensis*, *Curcuma angustifolia*, *Dioscorea alata*, *Dioscorea oppositifolia*, *Diospyros melanoxylon*, *Glinus oppositifolius*, *Ipomoea aquatica*, *Moringa oleifera*, *Phyllanthus emblica*, *Senna tora*, *Syzygium cumini* and *Ziziphus mauritiana*. About one gram of fresh sample (edible parts) was taken for each determination.

## **2.4 Chemical analysis**

Crude protein content of the fresh fruit samples was determined by following Bradford method (Sawhney & Singh, 2006). For extraction of total sugar Anthrone-Suphuric acid reagent test was applied (Sawhney & Singh, 2006). For extraction of total lipid, Chloroform:



Methanol mixture (2:1 vol) test was applied (Sawhney & Singh, 2006). Visual titration method based on reduction of 2, 6- dichlorophenol indophenols dye was adopted for estimation of ascorbic acid (vitamin C) content (Sawhney & Singh, 2006). Spectrofluorometric method using oxidising agent potassium ferricyanide was adopted for quantitative determination of thiamine (vitamin B1) content of selected fresh (edible part) sample (Sawhney & Singh, 2006).

### 3. Results

#### 3.1 Enumeration of plants

**Alternanthera sessilis** (L.) R. Br. ex DC. (Amaranthaceae) O: *Madaranga*

Annual prostrate or ascending herb. Leaves and leafy shoots are collected, fried/ roasted then eaten. Common weed. Available during July – January.

**Amorphophallus paeoniifolius** (Dennst.) Nicolson var. **campanulatus** (Decne) Sivadasan (Araceae), O: *Olakunda, Olua*

Herb. *Use*: Underground fleshy tuber and corms are first boiled with rice husk and kept overnight then sliced and cooked along with boiled potato or other vegetables are made into chutney. Common, often near villages and also cultivated. Available during April – November.

**Caralluma adscendens** (Roxb.) R. Br. (Asclepiadaceae) O: *Hada-sinkula*

Herb or under shrub. Fresh stem eaten as raw. Grow on bare rocks, hillsides. In all seasons.

**Colocasia esculenta** (L.) Schott (Araceae) O: *Saru*.

Herb. *Use*: Rhizomes, tubers and corms are consumed as vegetable after boiling and cooking. Corm makes chutney along with curry leaf (*Murraya koenigii*). Corm pieces smeared with rice flour are fried as cake. Common in damp shady places. Available during June – November. Evolved varieties are commonly cultivated.

**Commelina benghalensis** L. (Commelinaceae) O: *Kaniseera*

Diffused or erect herb. Leaves and young shoots are collected, fried/ roasted then eaten. Common weed in wet places. Available during September – January.

**Curcuma angustifolia** Roxb. (Zingiberaceae) O: *Palu kanda, Palua* Herb. *Use*: Rhizomes are roasted, cooked then consumed by tribal people. Rhizome is rubbed on stone, dissolved in



sufficient water, filtered and allowed to evaporate. The starch powder obtained after sun-drying is cooked into pudding (khiri) along with sugar. Frequent in forest.

**Dioscorea alata** L. (Dioscoreaceae) O: *Khambo alu* Twiner, stem twining to right Use: Tribal people eat tuber raw or after boiling. These are said to be sweet. Commonly cultivated. Available during October – December.

**Dioscorea oppositifolia** L. (Dioscoreaceae) O: *Pani alu* Strong twinner, stem twining to right. Use: Tuber peeled and eaten raw or sliced cooked with other vegetable and onion and consumed as curry. Occasional in forest. Available during June –September.

**Diospyros melanoxylon** Roxb. (Ebenaceae) O: *Kendu* Large tree. Ripe fruita are eaten as raw. Common in dry mixed deciduous forest. Available during March – April.

**Glinus oppositifolius** (L.) Aug. DC. (Molluginaceae) O: *Pita-saga* Small diffuse or prostrate herb. Young leaves and shoots are collected, roasted then eaten. Common in sandy soil, especially along river banks. Available during March – October.

**Ipomoea aquatica** Forssk. (Convolvulaceae) O: *Kalamba-saga, Tuti-saga*. Herb. Leaves and tender shoots are collected, cooked and then eaten. Trailing on mud or floating in water, common in water bodies. Most part of the year.

**Moringa oleifera** Lam. (Moringaceae) O: *Sajana* Small perennial tree. Leaves are eaten after frying or roasting. Liquid curry is prepared with fermented rice water and rice granules. Commonly cultivated in backwards. Available during January – June.

**Phyllanthus emblica** L. (Euphorbiaceae) O: *Amla* Small or moderate- sized tree. Matured fruits eaten as raw; made into pickle. Common in forests. Available during May – April.

**Senna tora** (L.) Roxb. (*Cassia tora* L.) (Caesalpiniaceae) O: *Chakunda* Herb or undershrub. Tender leaves and shoots are cooked and then taken as food. Fairly a common weed. Monsoon period.

**Syzygium cumini** (L.) Skeels (Myrtaceae) O: *Jamukoli* Large glabrous tree. Ripe fruits consumed as raw. Fairly common in forest. Available during June – August.

**Ziziphus mauritiana** Lam. (Rhamnaceae) O: *Barkoli* Branched, thorny moderate tree. Ripe fruits are eaten raw or as pickle. Abundant in sandy river banks, scrub forests and along road sides. Available during November – February.



### **3.2 Taxonomic diversity**

The study provides information on 16 edible plant species under 15 genera and 15 families. Of these, 10 species are dicotyledons under 10 genera and 10 families; 6 species are monocotyledons under 5 genera and 5 families. The edible plants include 12 wild species, 2 cultivated specie and 2 specie that are wild as well as cultivated.

### **3.3 Growth form**

The growth form of the edible plants as observed in the study includes herb, twiner and tree species. Out of 12 species recorded; are 9 herbs, 2 twiners and 5 tree species.

### **3.4 Preparation technique**

The edible parts consumed as vegetable are leafy vegetables, fruit plant and edible underground parts. Based on local use, the edible plants are consumed in different ways using different preparation methods. Three methods such as eating raw, roasted/fried with salt, cooked as curry were observed. Some edible plants are used as medicinal plants because of their because of their assumed health benefits, thus can be called as foodcum- medicinal plants.

### **3.5 Use category**

Analysis of data on use category showed that the identified edible plant species provide 8 major edible use categories based on local practices such as food supplement, pulp, pickle, chutney, Khiri, Jam or jellies and medicine.

### **3.6 Nutritional evaluation**

Plant species (16) selected for nutritional analysis are listed with botanical name, odia name and the estimated value of various nutritional compound observed in 12 edible plant parts are shown in Table 1.

#### **Crude protein content**

All the selected plants showed high amount of crude protein. Leafy vegetable *Moringa oleifera* (66.17 mg g<sup>-1</sup>) exhibited the highest crude protein while *Phyllanthus emblica* (6.17 mg g<sup>-1</sup>) had the lowest value (Table 1).



### Total sugar content

Out of 16 different plants studied, tuber of *Dioscorea opositifolia* (308.50 mg g<sup>-1</sup> , 33.9%) showed the highest total sugar content and the lowest value was exhibited by leafy vegetable *Commelina benghalensis* (23.53 mg g<sup>-1</sup> ) (Table 1).

### Total lipid content

Among the 16 edible plants studied, Leafy vegetable *Moringa oleifera* and *Senna tora* contained the highest lipid content (0.013 mg g<sup>-1</sup>) Lowest fat content has shown tuber of *Dioscorea alata* ( 0.001 mg g<sup>-1</sup> )(Table 1)

### Vitamin content

The result of vitamin analysis of edible plant showed that leafy vegetable *Glinus opositifolius* has vitamin B1 (0.0015 mg g<sup>-1</sup>) The result of vitamin C analysis showed that fruits of *Phyllanthus emblica* (5.16 mg g<sup>-1</sup> ) exhibited the highest vitamin C content and content the lowest value was shown by fruits of *Diospyrous melanoxylon* (0.02 mg g<sup>-1</sup> ) (Table1).

**Table 1. Crude protein, total sugar, fat and vitamin B1 and C content of some of the selected edible plants of South Odisha**

(Values are mean ± standard deviation, n = 3)

Plants	Odia name	Crude protein (mg g <sup>-1</sup> )	Total sugar (mg g <sup>-1</sup> )	Total lipid (mg g <sup>-1</sup> )	Vit.B1 (mg g <sup>-1</sup> )	Vit C (mg g <sup>-1</sup> )
<i>Alternanthera sessilis</i>	<i>Madaranga</i>	49.83 ±0.76	115.50 ±0.50	0.009 ±0.005	Nil	0.163 ±0.03
<i>Amorphophallus paeoniifolius</i>	<i>Olua</i>	11.1 ±1.26	184.5 ±0.79	0.001 ±0.0006	0.0006 ±0.0001	Nil
<i>Caralluma adscendens</i>	<i>Hada-sinkula</i>	30.40 ±0.79	58.16 ±1.03	0.005 ±0.002	Nil	0.160 ±0.02
<i>Colocasia esculenta</i>	<i>Saru</i>	32.92 ±0.39	222.85 ±0.58	0.002 ±0.001	0.0007 ±0.0001	Nil
<i>Commelina benghalensis</i>	<i>Kaniseera</i>	20.97 ±0.54	23.53 ±0.45	0.004 ±0.002	Nil	Nil
<i>Curcuma angustifolia</i>	<i>Palua kanda</i>	25.40 ±0.56	105.17 ±1.04	0.003 ±0.002	Nil	Nil
<i>Dioscorea alata</i>	<i>Khamba alu</i>	12.8 ±0.76	211.17 ±1.26	0.001 ±0.0006	Nil	Nil
<i>Dioscorea</i>	<i>Pani alu</i>	29.44	308.50	0.006	Nil	Nil



<i>oppositifolia</i>		±0.59	±1.80	±0.003		
<i>Diospyros melanoxydon</i>	<i>Kendu</i>	8.64 ±1.18	266.00 ±1.73	0.002 ±0.001	0.0004 ±0.0002	0.02 ±0.01
<i>Glinus oppositifolius</i>	<i>Pita saga</i>	25.83 ±1.90	129.89 ±0.79	0.006 ±0.004	0.0015 ±0.0001	0.35 ±0.01
<i>Ipomoea aquatica</i>	<i>Kalamba saga</i>	28.67 ±1.61	31.03 ±0.61	0.005 ±0.002	0.0005 ±0.0001	0.34 ±0.03
<i>Moringa oleifera</i>	<i>Sajana</i>	66.17 ±1.04	125.50 ±0.50	0.013 ±0.004	0.0007 ±0.0001	2.166 ±0.15
<i>Phyllanthus emblica</i>	<i>Amla</i>	6.17 ±0.76	136.17 ±1.04	0.004 ±0.001	0.0003 ±0.0001	5.16 ±0.76
<i>Senna tora</i>	<i>Chakunda</i>	49.17 ±1.04	54.67 ±1.53	0.013 ±0.005	0.0008 ±0.0001	0.790 ±0.03
<i>Syzygium cumini</i>	<i>Jamukoli</i>	8.17 ±1.04	140.83 ±1.04	0.005 ±0.001	0.0003 ±0.0001	0.19 ±0.01
<i>Ziziphus mauritiana</i>	<i>Barakoli</i>	7.67 ±1.53	165.50 ±0.50	0.002 ±0.001	0.0008 ±0.0002	0.74 ±0.02

#### 4. Discussion

During the study period it was recorded that tribal and rural people of south Odisha use 16 edible plant species. The edible parts consumed as vegetables are fruits, leafy vegetables and edible underground part. The edible plant parts are mostly collected free from the environment, 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 (Panda & Misra, 2011). Out of these about 3900 wild plants are used as food that is mostly consumed during emergency (Anonymous, 1995). Consumption pattern of wild food plants depends mostly upon their availability in nature. Majority of the wild edible fruit plants are consumed by tribal and non-tribal people due to their poor economic condition. However, it is established that most of the wild food plants are rich in nutrients and vitamins (Anonymous, 1995). The result of nutritional analysis of selected plants showed that edible underground parts are rich in carbohydrate, fruit plants are rich in vitamins and leafy vegetables are rich source of protein. Fresh leaf of *Moringa oleifera* contains at least twice more proteins than milk and half the protein of eggs (Souza and Kulkarni, 1193) . It was also reported that 30 g of drumstick leaf powder can cover one third of the daily allowance for





protein [Broin, 2006]. High carbohydrate content of feed is desirable; the deficiency causes depletion of body tissues (Barker, 1996). Most of the selected fruit plants reported have high total lipid values. Lipids are essential because they provide the body with maximum energy; approximately twice that for an equal amount of protein or carbohydrate and facilitate intestinal absorption and transportation of fat-soluble vitamins A, D, E and K (Dreon et al., 1990). Vitamin C (ascorbic acid) is an important water soluble vitamin already implicated in most of the life processes but principally functions as an antioxidant. Among the fruit analyzed, *Phyllanthus emblica* exhibited the highest vitamin C content. The relatively high amount of ascorbic acid in some selected fruits may be due to its acidity arising from the sour taste, since ascorbic acid occurs more in acidic medium than at high pH values (Mapson, 1970).

Besides their usage as food item, these edible plants are also exploited for their medicinal properties. Most of these species are utilised against various diseases by the local communities through their indigenous knowledge. For example, Fruit and seeds of *Zizyphus mauritiana* are consumed with salt to control vomiting (Shukla & Chakravarty, 2012). *Ipomoea aquatica* acts as a blood purifier and cure gonorrhoea (Amminudin and Girach, 1993). The leaves of *Senna tora* pounded with egg albumin are applied externally as a plaster on bone fracture (Anonymous, 2002.) In *Moringa oleifera*, the leaf powder is used as a dietary supplement for pregnant and lactation women to increase milk production and expel intestinal worms (Mosquin, 2008). Traditionally, fresh and dried *Moringa oleifera* leaves treat different ailments such as anaemia, abnormal blood pressure, headache, chest congestion, glandular swelling, sprain, joint pain, pimples and psoriasis (Fahey, 2005). The rhizomes of *Curcuma angustifolia* are often used in folk medicine as stimulant, digestive, stomachic and therefore rhizome is not only culinary but also medicinal to increase the digestibility of the cooked food (Misra et al, 2013) *Dioscorea alata*, the boiled tuber is useful in leprosy, piles and gonorrhoea (Das & Ramakant, 1988). This study highlights the significance of edible plant species as a source of nutrients for tribal people. The data reported show that the various plants are rich in nutrients and can serve as potential sources of food nutrient for the tribal rural people of southern Odisha. The analysis of 16 wild edible plants bring into focus the rich nutritional composition of indigenous plants and the scope for their use as an alternative source of bio-nutrition.



## 5. Conclusion

The results of the study revealed that the practice of consumption of wild edible plants still alive among the tribal communities of south Odisha, which are taken as food supplements and further to fill the gap of food deficiency during critical periods. The less availability of sufficient food, poor accessibility and marketability and very low agriculture yield are the main attributes for use of wild plants parts as food items as observed in the study area. With the effect of several factors such as influence of modern lifestyle on younger generation with change in dietary habits and their impression of forest plants as poor men's food, agriculture encroachment and launching of Government schemes on food security, we have started to lose the indigenous knowledge required to identify, locate, gather and know the consumption pattern of wild edible species. However, the forest food plants are neglected and underutilized due to lack of awareness, little research attention, poor commercialization and deficient policy frameworks for harnessing their actual potential in tribal/rural communities. Thus public awareness and community based programmes through joint forest management plan need to be encouraged at all levels for *ex situ* and *in situ* conservation of such species of future potential to enhance the food security of tribal communities of south Odisha.

## References

- [1]. Abubakar S., G.H. Ogbadu, A.B. Usman, O. Segun, O. Olorode and I.U. Samirah, 2012, The underutilized vegetable plants of the federal capital territory (FCT) Abuja of Nigeria, *Int j Development and Sustainability*, 1(3):634–643.
- [2]. Aminuddin and R.D. Girach, 1993, Observations on Ethnobotany of the Bhungia- A tribe of Sonabera plateau, *Ethnobotany*. 5:83-86.
- [3]. Anonymous, 2003, The Wealth of India- A Dictionary of Indian Raw Materials and Industrial Products.1st Supplement series, Raw Material, National Institute of Science Communication & Information Resources, CSIR, New Delhi, Vol 4 (J-Q); pp 214-215.
- [4]. Anonymous, 1995, Ethno-Biology, in: India: A Status Report. All India Coordinated Research Project on Ethno-biology, Ministry of Environment and Forests, Government of India, New Delhi.
- [5]. Barker M.M., 1996, Nutrition and dietics for Health Care. 9th Edn. Churchill Livingston. New York, pp. 92–101.
- [6]. C.P. Kala, 2007a, Prioritization of cultivated and wild edibles by local people in the Uttaranchal hills of Indian Himalaya, *Indian J Tradit Knowl*. 6 239–243.
- [7]. D Mosquin, 2008, *Moringa oleifera* Lam. [http://www. botanicalgarden.ubc. ca/potd/2008/05/moringa\\_oleifera. .php](http://www.botanicalgarden.ubc.ca/potd/2008/05/moringa_oleifera.php).
- [8]. Dahot M.U., 1993, Chemical evaluation of the nutritive value of flowers and fruits of *Capparis deciduas*, *J Chem Soc Pak*, 15(1): 78–81.



- [9]. Dreon D.M., K.M. Vranizan, R.M. Krauss, M.A. Austin and P.D. Wood, 1990, the effects of polyunsaturated fat and monounsaturated fat on plasma, Lipoproteins, *J Am Med Assoc*, 263: 2462–2466.
- [10].FAO (Food and Agriculture Organization of the United Nations) 2004, the state of food insecurity in the world monitoring the progress towards the world food summit and millennium development goals. Annual Report, Rome.
- [11].FAO, 1999, Use and potential of wild plants in farm households. Food and Agriculture Organization of United Nations, Rome.
- [12].FAO, 2004, the state of food insecurity in the world monitoring the progress towards the world food summit and millennium development goals. Annual Report, Rome.
- [13].FAO, 2005, Building on gender, agro-biodiversity and local knowledge. A training manual. Food and Agriculture Organization, Rome.
- [14].G. Shukla, and S. Chakravarty, 2012, Ethnobotanical plant use of Chilapatta Reserved forest in West Bengal, *Indian Forester*. 138(2):1116-1124.
- [15].Girach R.D. and Aminuddin, 1992, Addition to little known edible plants from Orissa, *J Econ Tax Bot*, 16(3): 589–594.
- [16].Girach R.D., Aminuddin and I. Ahmed, 1988, Observation on wild edible plants from tribal pockets of Orissa, *Plant Sci. Res.*, 10(1): 16–25. .
- [17].J.C. Rana, K. Pradheep, O.P. Chaurasia, S. Sood, R.M. Sharma, A. Singh and R. Negi, 2012, Genetic resources of wild edible plants and their uses among tribal communities of cold arid region of India, *Genet Resour Crop Evol*. 59 135–149.
- [18].Ju Y., J. Zhuo, B. Liu and C. Long, 2013, Eating from the wild: diversity of wild edible plants used by Tibetans in Shangri-la region, Yunnan, China, *J Ethnobiol Ethnomed*, 9:28. doi:10.1186/1746-4269-9-28.
- [19].JW Fahey, 2005, *Moringa oleifera*: A review of the medical evidence for its nutritional, therapeutic and prophylactic properties Part 1.Trees for Life Journal a forum on beneficial trees and plant.
- [20].K. Balemie, F. Kebebew, 2006, Ethnobotanical study of wild edible plants in Derashe and Kucha Districts, South Ethiopia, *J Ethnobiol Ethnomed*. 2:53. Doi: 10.1186/1746-4269-2-53
- [21].Kang Y., L. Luczaj, J. Kang, F. Wang, J. Hou and Q. Guo, 2014, Wild food plants used by the Tibetans of Gongba valley (Zhouqu County, Gansu, China), *J Ethnobiol Ethnomed*, 10:20.
- [22].M Broin, 2006, the nutritional value of *Moringa oleifera* Lam. leaves: what we can learn from figures, 2006 *Moringa News Workshop*. 2006. [http://www. Moringanews. Org/doc/GB/Posters/Broin\\_poster.pdf](http://www.Moringanews.Org/doc/GB/Posters/Broin_poster.pdf).
- [23].Mahapatra A.K., S. Mishra, U.C. Basak and P.C. Panda, 2012, Nutrient analysis of some selected wild edible fruits of deciduous forests of India: an Explorative study towards non conventional bio-nutrition, *Advance J Food Sci Tech*, 4(1): 15–21.
- [24].Maheswari J.K. and J.P. Singh, 1984, Contribution to the ethnobotany of Bhoxa tribe of Bijnor and Pauri Garhwal district, U. P., *J Econ Tax Bot*, 5: 251–259.
- [25].Mapson L.W., 1970, the Vitamins. W.H.Jr. Sebrelle and R. J. Harris, (eds).Vol 1 pp369 – 385. Academic Press. London.
- [26].Misra S., R.K. Maikhuri, C.P. Kala, K.S. Rao and K.G. Saxena, 2008, Wild leafy vegetables: a study of their subsistence dietetic support to the inhabitants of Nanda Devi Biosphere Reserve, India, *J Ethnobiol Ethnomed*, 4(1):15.
- [27].Misra M.K., P.K. Das and S.S. Dash, 2009, Phytodiversity and Useful Plants of Eastern Ghats India (A special reference to the Koraput region). International Book Distributors, Dehra Dun.
- [28].Nazarudeen A., 2010, Nutritional composition of some lesser-known fruits used by the ethnic communities and local folks of Kerala, *Indian J Trad Knowl*, 9(2): 398–402.
- [29].Das P.K. and Ramakant, 1988, Ethno botanical studies of the tribal belt of Koraput (Orissa), *B. M. E. B. R.* 9: 123-128.



- [30].R.K. Maikhuri, K.S. Rao, K.G. Saxena, 2004, Bioprospecting of wild edibles for rural development in the central Himalayan Mountains of India, *Mountain Res Dev.* 24(2): 110–113.
- [31].Rashid A., V.K. Anand and J. Serwar, 2008, Less Known Wild Edible Plants Used by the Gujjar Tribe of District Rajouri, Jammu and Kashmir State, *Int J Bot*, 4 (2): 219–224.
- [32].S. Misra, R.K. Maikhuri, C.P. Kala, K.S. Rao, K.G. Saxena, 2008, Wild leafy vegetables: a study of their subsistence dietetic support to the inhabitants of Nanda Devi Biosphere Reserve, *India, J Ethnobiol Ethnomed* , 4(1): 15.
- [33].Sankaram M., Jayprakash, N.P. Singh and Suklabaidya, 2006, Wild edible fruits of Tripura, *Natural Product Radiance*, 5 (4): 302–305.
- [34].Sawhney S.K. and R. Singh, 2006, *Introductory Practical Biochemistry*. Narosa Publishing House Pvt. Ltd. Delhi, pp 1–190.
- [35].Saxena H.O. and M. Brahmam, 1994–1996, *The Flora of Orissa*. 4 Vols. Regional Research Laboratories and Forest Development Corporation Ltd., Bhubaneswar, Orissa.
- [36].Shrestha P.M. and S.S. Dhillion, 2006, Diversity and traditional knowledge concerning wild food species in a locally managed forest in Nepal, *Agroforestry Systems*, 66:55–63.
- [37].Suresh C.P., K.D. Bhutia, G. Shukla, K. Pradhan and S. Chakravarty, 2014, Wild edible tree fruits of Sikkim Himalaya, *J Tree Sci*, 33(1): 43–48.

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