

# Tendu: An Underutilized Fruit with Vast Nutritional and Phytochemical Potential

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**Abstract**—Tendu fruit is one of the important forest fruit found in Jharkhand, Odisha, Madhya Pradesh, Maharashtra, Andhra Pradesh, Chhattisgarh, Tamil Nadu, Kerala and Karnataka. The plant is well known for its leaves which is known as Bidipatta and use for making bidi in tribal areas of India. The study was carried out on physico-chemical, nutritional analysis and Antioxidant profiling of the Tendu fruit pulp. The fruit pulp was found to be rich in sugar, mineral and vitamins content. The sugar content in the fruit pulp was reported as 19.99 %. The fruit pulp was found to be an excellent source of potassium and phosphorus with values as high as 311.6 and 163.9 mg/100gm respectively. The fruit was also reported to be rich in minerals such as Calcium, Magnesium and Sodium @ 90.86, 56.29 and 87.12 mg / 100 gm respectively. Vitamin C, Thiamine, Riboflavin, Niacin & Carotene were found to be present in fair amount. Further, the antioxidant activity of the fruit pulp was found to be comparable with vitamin C that confirmed Tendu fruit pulp contains bioactive compounds which are responsible for the antioxidant activity.

**Keywords:** Tendu/ Kendu fruit, Vitamins, Minerals, Antioxidant activity.

## 1. INTRODUCTION

Tendu (*Diospyros melanoxylon*) belong to Ebenacea family and is a tree native to India, Pakistan and Nepal. In India it is found in Madhya Pradesh, Chhattisgarh, Maharashtra, Orissa, Uttar Pradesh, Bihar, Jharkhand and Western Peninsula. The English name of the fruit is ebony, persimmon & Coromandel ebony.

The plant is more popular among the tribal people for its leaves than its fruits. The leaves are used in Bidi Industries for making 'Bidi' / 'Cigarettes'. The plant grows best on loose soil in cool and moist sheltered valley.

Each part of the plants is useful such as leaves are used for making bidis and are carminative, laxative, diuretic stypic, the ripen fruits are antibilious i.e. prevent biliousness, bark is astringent and used in treatment of dyspepsia and diarrhoea, unripe fruit is carminative and astringent, dried flowers are used in treatment of anaemia, inflammation of spleen, leucorrhoea. The aerial part of the plant is hypotensive (lowering the blood pressure). [3]

The fruits of the Tendu are edible and have with short shelf life due to higher concentration of sugar. The fruit get wasted due to lack of proper technology for value addition in forest area.

## 2. BOTANICAL FEATURE OF TENDU PLANT

Tendu is moderate sized deciduous trees up to 25 m length and 2 m in girth. Under natural conditions seeds germinate in the rainy season and seedling reproduction is often plentiful. The sapwood of Tendu is light roseate grey aging to light roseate brown. The heartwood is sharply delimited from the sapwood and is black, often streaked with purple or brown bands. The sapwood is extensively used for posts, rafters, shafts and poles of carts. It is suitable for picking arms, billiard cues, plumbers 'tools and agricultural impalements. It should be useful for a large variety of articles requiring strength, elasticity and finish. The bark and half ripe fruit contain 15 and 23 % tannin respectively. The species is considered important for reforestation purpose.

## 3. NUTRITIVE VALUE OF TENDU FRUIT

The fruit has a great socio-cultural importance in Odisha, Jharkhand, Madhya Pradesh, Maharashtra and Karnataka especially among the tribal communities. [9] An adult tree yield around 80-100 kg of fruits per year. They tribal use to prepare bidis from leaves and sell the fresh fruit for income generation and dried fruit pulp for consumption in rainy season when shortage of the food/ food grains faced [2]. The fruit is globose 1-1.5 in diam and edible. The fruit is seasonal and ripen fruits are available from March to June. Tendu fruit is round in shape; the taste of the fruit pulp is sweet and pleasant [10]. The colour of the fruit is of yellow golden with short shelf life. The ripe fruit is rich in sugars which limits its shelf-life. The fruit is covered with skin /peel which is hard and thick. Fruit contains 3-5 no of seeds embedded firmly in the pulp. The seeds are dark brown in color and the seed coat is very hard. The centre part contains white color. The study of National Institute of Nutrition, Hyderabad reveals that Tendu fruit is rich source of Carbohydrate, Calcium, Phosphorous and Carotene [5].

**Table 1: Proximate composition of Fruit**

S. No.	Parameters	Value
	Moisture content (%)	69.6 ±30.3
	Crude protein mg/ g	8.64 ±1.18
	Total sugar mg/g	266.00 ±1.73
	Total lipid mg/g	0.002 ±0.001
	Vitamin B1 mg/g	0.0004 ±0.0002
	Vitamin C mg/g	0.02 ±0.01

Source: [11]

In the study undertaken by the authors, the fruit pulp has been found to be rich in sugar, mineral and vitamins content. The sugar content in the fruit pulp was reported as 19.99 %. The fruit pulp was found to be an excellent source of potassium and phosphorus with values as high as 311.6 and 163.9 mg/100gm respectively. The fruit was also reported to be rich in minerals such as Calcium, Magnesium and Sodium @ 90.86, 56.29 and 87.12 mg / 100 gm respectively. Vitamin C, Thiamine, Riboflavin, Niacin & Carotene were found to be present in fair amount.

#### 4. TRADITIONAL USES

Traditionally, the tribal collected the fruits and store them for their consumption when there is scarcity of food. It has been reported that the tendu fruit contained alkaloids, flavonoids, steroid, tannins saponins and terpenoids when the methanol extract of the fruit were studied. [6,7]

#### 5. MEDICINAL PROPERTIES

The fruit has cooling and astringent effect [8]. Fruits are oleaginous, heating, carminative, astringent to bowels, cures ulcers, diseases of blood, urinary losses and stone in urinary tract. The fruits are aphrodisiac and tonic.

The pulp of unripe fruit is applied externally in cracked or inflamed soles of feet [1]. The herb collectors of Kondagaon region reported that fresh fruit juice of Tendu fruit possess styptic properties and use its juice is used to stop bleeding. The traditional healers of Narharpur region, Chhattisgarh collect the rind of Tendu fruits and burn it and patient suffering from respiratory trouble and asthma are advised to inhale the fumes[9]. The properties of the ripe and unripe fruit as per Ayurveda:

##### Unripe fruit:

Grahi – absorbent, bowel binding, useful in IBS, diarrhoea  
 Vatala – Increases Vata Dosha  
 Rooksha – dry  
 Sheetala – coolant  
 Laghu – light to digest  
 Lekhana – scraping  
 Vibandhakrut – causes constipation  
 Aruchikrut – May cause anorexia

##### Ripe fruit:

Madhura – sweet  
 Guru – heavy  
 Balances Pitta and Kapha  
 Indicated in  
 Prameha – Urinary tract disorders, diabetes  
 Asra – blood vitiation disorders such as abscess, bleeding disorders, vascular disorders etc

#### 6. PHYTOCHEMICAL PROPERTIES

The studies conducted till date have indicated tendu plant as a rich source of bioactive compounds. The research have been conducted on different parts of plants to identify the phytochemical compounds present in them.

**Table 2: Chemical Compounds of Diospyros melanoxylon Roxb.:**

Part	Compounds
Heart wood	b-sitosterol terpenoid, Lupeol, Betulin, Betulinic acid, 2-methyl-5-methoxy-1, 4-naphthaquinone, 3-methyl-8-methoxy-1, 9, naphthaquinone, 2-methyl-3-hydroxy-5-methoxy, and 2-methyl 5, 6, Di methoxy-1, 4-naphthaquinone.
Leaves	b- sitosterol, Monohydroxy monocarboxylic acid, Monohydroxy triterpene, Bauererys acetate, Ursolic, Betulinic acid, Baurenol, ursolic, Diospyric acid, Isobaneranol, Methyl betulinate.

Source:[12].

The authors have studied the antioxidant activity of the fruit pulp(DPPH and FRAP Assay), which was found to be comparable with vitamin C. This confirmed that Tendu fruit pulp contains bioactive compounds which are responsible for the antioxidant activity. The tannin content was also estimated and was found to be high in fruit pulp.

#### 7. POTENTIAL USES

The fruit pulp can be used for value addition purposes and product development for commercial purposes.

##### 7.1.Dried and Powdered Fruit

The fruit powder can be used for value addition in many products like fruit beverages, jams, jellies, etc.

**Table 3: Proximate analysis of dried and powdered fruits:**

Parameters	Value
Ether extract	2.1%
Alcohol extract	6.3%
Water extract	4.4%
Albuminous matter	16.4%
Organic residue	65.1%
Ash	5.7 %

Source: [14]

## 7.2 Tendu Fruit Wine

The tendu fruit wine was developed and its antioxidant properties were evaluated [13]. During processing Must from tendu fruits was adjusted to 20° B TSS and 0.1% (NH<sub>4</sub>) SO<sub>4</sub> was used as nitrogen source, 2% *Saccharomyces cerevisiae* var. *ellipsoideus* (wine yeast) culture used for fermentation of the wine. The result obtained is given below:

**Table 4 : Composition and antioxidant properties of must and wine**

Parameters	Must	Wine
TSS(oBrix)	20±0.01	2.0±0.00
Total sugar(g/100ml)	24.55±0.95	3.78±0.13
Titriable acidity (g/tartaric acid/100ml)	0.85±0.16	1.32±0.52
pH	5.10±0.28	3.12±0.12
Phenols (g/100ml)	1.00±0.32	0.95±0.45
Ascorbic acid (Vit -C) (mg/g)	2.00±0.05	1.52±0.22
Lactic acid(mg/100ml)	0.01±0.00	0.39±0.05
â-carotene (mg/100ml)	18.00±2.1	8.00±0.00
Methanol(%)	ND	3.5± 0.00
Ethanol(%)	ND	6.8±0.32
DPPH(%)	72.5±2.80	52.0±2.15

Source: [13]

## 8. CONCLUSION

The tendu plant is widely cultivated in India for its culinary purposes. The plant is very useful and all the parts of the plants can be used for different purposes. The ripe fruits are edible and have high nutritive value. It is found to be a rich source of many vitamins and minerals like potassium, phosphorus, vitamin A, etc. The fruits have traditional uses and are used in both ripened and unripened form for their medicinal and phytochemical properties. They are being used for treatment of several diseases in tribal and rural areas. The only drawback with this fruit is its very short shelf-life and tannin content. But, still the fruit has a huge potential to be used commercially because of its nutritive, medicinal and phytochemical properties.

### References:

- [1] Ashok K. Jain, Mohan G Vairale & Rajdeo Singh, Folklore claims on some medicinal plants used by Bheel tribe of Guna district Madhya Pradesh, Indian Journal of Traditional Knowledge, Vo 9 (1) Jan 2010 Pp- 105-107.
- [2] Behera, M. (2009). Non-timber forest products and tribal livelihood: A case study from Kandhamal district of Orissa. Indian Forester, 1127-1134.
- [3] Khare C.P., Indian Medicinal Plants, An Illustrated Dictionary, ISBN : 978-0-387-70637-5, 2007.
- [4] Gupta, V., Maitili, V., & Vishwakarma, P. K. (2013). Comparative study of analgesic activity of *Diospyros melanoxylon* (Roxb.) bark and root bark. Journal of Natural Remedies, 13(1), 15-18.
- [5] Gopalan. C., Sastri B.V.R & Balasubramanian S.C. Nutritive value of Indian foods, National Institute of Nutrition, ICMR, Hyderabad, 1989.
- [6] Maridass M., Ghanthikumar S., & Raju G., Preliminary phytochemical analysis of *Diospyros* species, Ethnobotanical leaflets 12: 868-72.2008.
- [7] Maridass M., Phytochemicals From Genus *Diospyros* (L.) and their Biological Activities, *Ethnobotanical Leaflets* 12: 231-244. 2008.
- [8] Orwa, C.; Mutua, A.; Kindt, R.; Jamnadass, R.; Anthony, S., 2009. Agroforestry Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya, 2009.
- [9] Pharmacognostic studies on *Diospyros melanoxylon*, International journal of Pharmaceutical science and research (2012), Vol 3, Issue 09, ISSN: 0975-8232.
- [10] Pradhan, K. (2008). Kendu Karisma- Value Added Organics from Kendu. Article on Wasteland News. May-July, 2008.
- [11] Sibangini Misra, Malaya K. Misra, International Journal of Advances in Agricultural Science and Technology, Vol 3, Issue 1, March 2016, Pg 1-30.
- [12] Sidhu, G.S., Sankaran, A.V.B and Mahmood Ali, S. 1968. *Indian J. Chem.*, 6, 681-691.
- [13] Sahu U. C., Sandeep K. Panda, Uma B. Mohapatra and Ramesh C. Ray, Preparation and evaluation of wine from tendu (*Diospyros melanoxylon* L) fruits with antioxidants, *Intl. J. of Food. Ferment. Technol.* 2(2): 167-178, December, 2012
- [14] The Wealth of India, A dictionary of Indian Raw Materials and Industrial Products, Vol- III: D- E (with Index to Vol I-III), Council of Scientific & Industrial Research, 1952, page- 81-84.