



## A Review on ‘Diospyros Melanoxylon’

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### ABSTRACT:

Diospyros melanoxylon, a member of the Ebenaceae family, is known botanically as Guab Persimmon, Coromandel Ebony, or Timroo. Although the entire plant is valuable medicinally and has been used for numerous ailments historically, there aren't many abstracts supporting this claim. It is utilized in the Ayurvedic Medical System as well. The underappreciated summer sweet fruit known as "fruit tendu" (Diospyros melanoxylon Roxb.) is a big source of nourishing and therapeutic values. These unique wild fruits got within Chhattisgarh, Maharashtra, other regions of Indian subcontinent and few countries of world are tendu fruit. The plant is popular for their leaves which are called 'Vidi Pan' and employed for manufacturing 'Vidi' in rural areas of India. Its leaves have great economic significance. Its fruits are consumed by a variety of animals, birds and provides an ecological and therapeutic benefits.

This plant has many economic and pharmacological potential such as anti-inflammatory, anti-diarrheal, anti-pyretic, analgesic, cooling and astringent effect and also treat the blood disorders. It can be used in urinary, skin diseases, nervous breakdown and palpitation of heart. Owing to these numerous properties, this plant has great future research scope in many fields. This review is an effort to throw light on such significant properties of the plant 'Diospyros melanoxylon'.

(**Keywords:** Tendu fruit, Pharmacological potential, Economic, Nutritional, Ayurvedic)

### Introduction:

The Temburani plant local at country and an individual from the Ebenaceae family [1]. It is alluded to as temburini locally. It is impervious to ice and dry spell, despite the fact that it is handily overwhelmed. It is likewise a huge yet less popular natural product that is used as a delicacy and is open in the nearby business sectors of many states all through the summer[2]. The natural products are extremely supplement thick and an incredible wellspring of fiber and phenols[3]. This natural product is involved by the nearby clan's kin as a mid year safeguard against loo or hot breezes. Diospyros means pure product and that implies fruit of heavenly plant, are the wellspring of the huge properties. The Greek expression explicitly signifies "dim."

### Origin and distribution:

Diospyros melanoxylon a blooming plant from Ebenaceae family that has tough and dehydrated bark[4]. It has large expected noun gets through Coromandel, the shore of southeastern India. According to Troup (1921) Diospyros melanoxylon (thorough of *D. tomentosa* and *D. tupru*) is one of the most brand name trees of the dry deciduous forest areas generally through India[5], covering the entire Indian body of land the area of course loosens up to Nepal in sub-Himalayan packages including the Indian plain, Gangetic plain, MP and MH, western coast up to Malabar and Eastern coast up to Coromandel[6]. The plant is similarly met with on the Nilgiris and Serawalli slants in the south. Vernacularly famous called temburini. Class diospyros have a spot with family Ebenaceae which has more than 400 species passed on over tropical and sub-tropical locales of the planet[7].

### Area or region of cultivation or availability:



Tendu plants tracked down in the wilderness of tropical and subtropical division. It is typically found in dry deciduous timberland as a constituent types of *Tectona grandis*, Sal and blended backwoods of *Acacia leucophlea*, *Boswellia serrata*, *Butea monosperma*, *Lantana coromandelica* and *Terminalia tomentosa*[8]. It is essentially accessible for its leaves utilized for Bidī[9]. Locals have there is networks which deal with the tendu leaves[10]. Thusly, assessed region isn't accessible.

#### Genus and different species:

*Diospyros* genus, family Ebenaceae has 400 species and more dispersed over the world. Arora and Pandey (1996) announced 12 species being tracked down in various pieces of India while Zeven and Zhukosky (1975) referenced 8 species in 5 habitats of origin[11]. It has 4 significant types of *Diospyros* which have business esteem. These are *D. Kaki*, *D. Lotus*, *D. Verginiana* and *D. oleifera*[12]. A rundown of plant animal categories alongside their nearby name, plant part/s involved and method of organization for compelling control in various diseases of ethnomedicinal plants are given[13]. The leaves have explicit size and the particular surface area[14].

#### Taxonomy:

Kingdom: Plantae

Phylum: Streptophyta

Class: Equisetopsida

Subclass: Magnoliidae

Order: Ericales

Family: Ebenaceae

Genus: *Diospyros*

Species: *melanoxylon*



#### Botanical Description:

##### growth habit:

In light of the environment the tree is deciduous or evergreen. Its misfortunes all leaf in the blistering climate and get back all leaves in May to June. It is evergreen in damp locality[15]. Tendu (*Diospyros melanoxylon*) is a medium-evaluated tree or bush to 25 m, and 1.9 m bigness. Its barks tone is dim. The essential root is long, thick and plump from the get go, a short time later woody, greyish, frequently enlarged in upper part close to ground level. Their foundations resemble vertical circles. The leaves are 35cm long and with time becomes full grown. Blooming happens during February - April[16]. It can likewise be filled in the callus culture[17].

##### Flower:

Tendu plants bear 3 kinds of blossoms for example pistillate, staminate and awesome, yet now and again dioecious circumstance do exists. Under such circumstances, appropriate pollinizers are required. Blossoms are generally three bloomed and whitish in variety and 1-1.5 cm long. Female blossom can be effortlessly recognized by presence of four heaved huge dim green calyx. The blossoms show up separately. Male blossoms are more modest than the female blossoms. The bisexual blossoms are transitional in size and periodically found in the bunch of male flowers[18].

##### Flowering:

Following 5-7 years the blooming begins in this plant and in wilderness it further get delay. The blooming happens on new development. In a large portion of the instance of tendu, bloom bud separation begins toward the beginning of June and go on up to August. The tendu plants entombs into floriferus stage during spring. The blossoms show up from April to June on new shoot and the natural products mature after 1 year[19].



#### **Fruit:**

Organic product gets joined to branches because of calyx stays in touch with natural product. Natural products olive green, ovoid or globose 3-4 cm across; 1, 2-, 3-, 4-, 5-, 6-, or 8 cultivated berries[20]. Mash is yellow, delicate and sweet[21]. Seeds compacted, elliptical, gleaming, frequently united. At times tendu set organic product parthenocarpically[22]. It has twofold sigmoidal development design. During the natural product improvements, dropping of unfertilized and bug harmed natural products become a serious issue which can be constrained by splash of GA3 at full blossom stage. Organic products are accessible in the long stretch of May and June. The tree delivers great seed in substitute year[23].



#### **Nutritive Value:**

The normal items are especially nutritive and rich wellspring of phenols and strands. Its natural item crush is yellow, glutinous, sensitive, sweet and to some degree astringent[24]. These natural items are abundant in sugars, proteins, fiber and L-ascorbic. Further, to presence of a couple of chivalrous phytochemicals, for instance,  $\beta$ -Carotene, terpenoids, flavonoids, saponin and tannin in the regular item add advantages to its nutritive worth. Prepared natural items are huge source some non-malignant growth counteraction specialists, unidentified oligosaccharide, fumaric and gallic acid[25]. The constituents of prepared normal items are according to the accompanying:

Ascorbic acid(Vit-C), Phenol,  $\beta$ -Carotene, Protein, Raw fiber, Glucose, Fructose, Dissolvable gelatin, Dissolvable tannin, and so on.

#### **Morphological Characteristics:**

*Diospyros melanoxylon* is a little tree to 6-10m; harsh bark is deciduous[26],[27]. It partakes in the full sun, part of deciduous woods type. 1. Leaves: *Diospyros melanoxylon* leaves are green on upper side, substitute, oval or oval-elliptical, generally adjusted at base and mucornate at summit, pubescent, persistent[28]. Certain states have colossal creation of leaves like MP, Jharkhand, etc[29]. 2. Inflorescence: These are yellowish-white, dioecious, cymose, thickly pubescent.

- Corolla is Inflorescence: 4-fid, glabrous, urceolate.
- Calyx is campanulate, tanish yellow, thickly pubescent.
- Corolla is urceolate, glabrous.
- Staminodes are 7-9, glabrous, hypogynous.

#### **Uses:**

This plant has been factual in Ayurveda and Unani texts and furthermore ethnobotanically[30] for its multi-reason use in various sicknesses. Wine can be ready from tendu organic products as like cashew apple, litchi and others tropical and sub-tropical fruits[31]. It has been utilized broadly in Indian customary medication to treat for different illnesses including the runs, cholera, diabetic[32], looseness of the bowels, irregular fevers, draining gums, bronchitis, carbuncles, hack, cramps, pneumonia, syphilis, growths, and so on. It has extraordinary financial values[33]. Indian Vidi is framed by wrapping the leaf of this plant[34], which are customary than cigarette in country[35],[36]. Its leaves are utilized for making bidi[37]. Tendu (*Diospyros*

melanoxylo) leaves make fantastic coverings, and the outcome of the beedi is expected, to some degree, to this leaf[38]. The composite shows solid antibacterial action against both Gram-negative *Escherichia coli* and Gram-positive *Staphylococcus aureus* bacterial microbes [39]. It has anticandidal, cell reinforcement activity[40],[41].

#### Ethnobotanical Uses:

The leaves are utilized as diuretic, carminative, purgative and styptic. Dried blossoms are helpful in urinary, leucorrhoea, frailty, skin contaminations, and blood diseases[42],[43]. The natural products have a cooling and an astringent impact and helpful in stomach disorders[44]. The bark is an astringent and its decoction is utilized to treat loose bowels and dyspepsia[45]. The seeds can be utilized to fix mental issues, sensory system breakdown, and palpitation of the heart[46]. The Tendu plant has likewise utilized for orchestrating the silver nanoparticles[39].

It kill to microbial movement also[47],[48]. The natural product strip has initiated carbon which go about as bioadsorbent for methyl blue dye[49],[50].



#### Plant Parts Activity:

Plant part used	Activity	Outcomes
Fruits	Cooling and astringent effect	Used to treat Fistula, skin care. Also used to make wine.
Leaves	Anti- inflammatory,	Treat swelling, ulcers[51], wound healing, hepatitis[52], diabetes[53],[54], snake bite, etc[55]
Stem bark	Antidiarrheal, anti- pyretic, anti-inflammatory, analgesic	Its decoction Treat dyspepsia and diarrhoea, alcoholic extract is anti- pyretic, anti-inflammatory, analgesic[56]
Seed	Anti mental disorder	Treat mental disorder[57], nervous breakdown and palpitation of heart
Flowers	Treat Blood disease	Useful in urinary, skin[58], and blood diseases

#### Phytochemicals as Biopesticides:

Phytochemicals have been recognized to work effective as biopesticides against in excess of 100 bugs of 10 distinct orders (Orthoptera, Dictyoptera, Lepidoptera, Homoptera, Heteroptera, Diptera, Coleoptera, Hymenoptera, Isoptera, Thysanoptera) and other 100 non-bug pests[59]. They can repress the spore germination and go about as development retardants of parasites and microscopic organisms. They can likewise assist in forestalling with hypnotizing of root nematodes[60]. The principal benefit of utilizing plant items (phytochemicals) as biopesticide is its biodegradable nature which doesn't let buildups to remain on plants[61]. Different elements are that they are viable against bugs, plant microbe, nematodes and non-bug pest[62]; non-contaminating and viable with other biopesticides. This plant likewise has triterpenoids[63].

#### Clinical and Toxicological Studies:

Sr. No	Plant species/ Plant part	Compound
1.	D. melanoxylon Roxb. (Heartwood)	b-sitosterolterpenoid[64], Lupeol[65], Betulin, Betulinicacid, 2-methyl- methoxy-14-naphthaquinone, 3-methyl-8-methoxy-1, 9, naphthaquinone,2-methyl-3-hydroxy-5 methoxy, and2 methyl5,6Dimethoxy-1,4 naphthaquinone[66]. naphthaldehyde[67], pentacyclic quinone diosindigo B[68]
2.	Leaves	b-sitosterol[69], Monohydroxymonocarboxylic acid, MonohydroxytriterpeneBauererys acetate, Ursolic[70], Betulinic acid, Baurenol, ursolicDiospyricacid, Isobanerenol, Methylbetulinate

The plant Diospyros melanoxylon has immense assortment of clinical purposes, for example, against diabetic, Hostile to cancer[71], calming, hostile to pyretic, diuretic, purgative, carminative, pain relieving and deals with different infections like ulcer, hepatitis, dyspepsia, the runs, mental turmoil, stoppage, cholera, hack, cramps, syphilis, etc[72].

Nonetheless, the over the top utilization of this plant can prompt switched impacts in some conditions[73]. For example The inordinate utilization of this plant cause emesis, sickness, etc[74].

#### Other Information:

Exchange and improvement of non-lumber woodland produce - including trade subtleties for significant products[75]. Tendu leaves are likewise utilized for making biodegradable plates, which would help in elevating the financial status of ancestral and provincial individuals as it is an extraordinary substitute choice for the utilization of biodegradable eating plates in future[76].The leaf squander utilized as the vermicompost manure[77],[78],[79].

#### Environmental Effect:

Impact on Climate and Environment a) For removal of waste tendu leaves land necessity is more b) Smoking of bidees prompts air contamination, it is unsafe for both dynamic and detached smokers c) Because of huge amount unloading it upsets the natural cycle[80]. d) Because of capacity for additional time, it welcomes flies and mosquitoes which are answerable for spreading of pathogenic infections. e) in blustery season because of dampness scent issues created[81].

## CONCLUSION:

With this we conclude that Diospyros melanoxylon has got many potential uses but the pace of research is very less on this tree. Astringent property of the melanoxylon was due to the presences of tannins. Stem bark decoction was found to have antidiarrheal property hence it could be used as natural drug. From the pharmacological review it could be noted that the plant leaves extract has got anti- inflammatory, antidiabetic properties which could be able to treat these diseases or disorders.

Not just these, this plant has numerous pharmacological actions such as anti -pyretic, analgesic and treat wounds, skin infections, hepatitis, fistula, snake bite, mental disorders and nervous breakdown also. Overall, there is vast scope to explore this plant to find out its new aspects also.

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#### References:

- [1] K. Rathore, V. K. Singh, P. Jain, S. P. Rao, Z. Ahmed, and V. D. Singh, "In-vitro and in-vivo antiadipogenic, hypolipidemic and antidiabetic activity of Diospyros melanoxylon (Roxb)," J Ethnopharmacol, vol. 155, no. 2, 2014, doi: 10.1016/j.jep.2014.06.050.
- [2] A. A. Boaz, "Case study of tendu leaves ( Diospyros melanoxylon ) in Harda district , Madhya Pradesh , India," : Forest Products, Livelihoods and Conservation, 2004.

- [3] Z. Jamil, A. M. Mohite, and N. Sharma, "PHYTO-CHEMICAL AND NUTRITIONAL PROFILING OF TENDU FRUIT (DIOSPYROS MELANOXYLON ROXB.) AND EVALUATION OF ITS SHELF STABILITY," *Plant Arch*, vol. 21, no. No 1, 2021, doi: 10.51470/plantarchives.2021.v21.no1.091.
- [4] K. M. Hosamani, "Unique Occurrence of Unusual Fatty Acids and Their Industrial Utilization," *Ind Eng Chem Res*, vol. 35, no. 1, 1996, doi: 10.1021/ie9405571.
- [5] T. Parveen and O. Ilyas, "Tree diversity and natural regeneration in Tropical Dry Deciduous Forest of Panna Tiger Reserve , India," *Res Sq*, 2021.
- [6] V. Deblauwe, "Life history, uses, trade and management of *Diospyros crassiflora* Hiern, the ebony tree of the Central African forests: A state of knowledge," 2021. doi: 10.1016/j.foreco.2020.118655.
- [7] G. B. Pawar, R. N. Mane, and S. R. Yadav, "Karyomorphological studies on two species of diospyros (ebenaceae) from India," *Cytologia (Tokyo)*, vol. 86, no. 3, 2021, doi: 10.1508/cytologia.86.221.
- [8] P. K. Pande, "Biomass and productivity in some disturbed tropical dry deciduous teak forests of Satpura plateau, Madhya Pradesh," *Trop Ecol*, vol. 46, no. 2, 2005.
- [9] J. Robert Hunter, "Tendu (*Diospyros melanoxylon*) leaves, bidi cigarettes, and resource management," *Econ Bot*, vol. 35, no. 4, 1981, doi: 10.1007/BF02858594.
- [10] A. Boaz and O. Boaz, "Community-based sustainable management of tendu leaves (*Diospyros melanoxylon* Roxb.): A case study of harda district of Madhya Pradesh, India," *General Technical Reports of the US Department of Agriculture, Forest Service*, no. 604, 2004.
- [11] S. C. Sahu, N. K. Dhal, and R. C. Mohanty, "Tree species diversity, distribution and population structure in a tropical dry deciduous forest of Malyagiri hill ranges, Eastern Ghats, India," *Trop Ecol*, vol. 53, no. 2, 2012.
- [12] V. S. S. Kantamreddi and C. W. Wright, "Investigation of Indian *Diospyros* species for antiplasmodial properties," *Evidence-based Complementary and Alternative Medicine*, vol. 5, no. 2, 2008, doi: 10.1093/ecam/nem019.
- [13] J. A., K. S.S., G. P.K., and S. P., "Medicinal plant diversity of Sitamata wildlife sanctuary, Rajasthan, India," *J Ethnopharmacol*, vol. 102, no. 2, 2005.
- [14] R. AS, "Leaf size and specific leaf area of tropical deciduous trees increase with elevation in soil moisture content," *International Journal of Hydrology*, vol. 2, no. 4, 2018, doi: 10.15406/ijh.2018.02.00112.
- [15] R. K. Chaturvedi, A. S. Raghubanshi, and J. S. Singh, "Growth of tree seedlings in a tropical dry forest in relation to soil moisture and leaf traits," *Journal of Plant Ecology*, vol. 6, no. 2, 2013, doi: 10.1093/jpe/rts025.
- [16] G. Panda, K. Vivek, and S. Mishra, "Physical Characterization and Mass Modeling of Kendu (*Diospyros melanoxylon* Roxb.) Fruit," *International Journal of Fruit Science*, vol. 20, no. S3, 2020, doi: 10.1080/15538362.2020.1851339.
- [17] N. Agarwal and Y. K. Bansal, "Incipient morphogenesis in callus cultures of a recalcitrant hardwood tree tendu (*Diospyros melanoxylon* Roxb.)," *Plant Arch*, vol. 13, no. 1, 2013.
- [18] C. Kamaraj, A. A. Rahuman, C. Siva, M. Iyappan, and A. V. Kirthi, "Evaluation of antibacterial activity of selected medicinal plant extracts from south India against human pathogens," *Asian Pac J Trop Dis*, vol. 2, no. SUPPL.1, 2012, doi: 10.1016/S2222-1808(12)60169-8.
- [19] G. Srivastava, R. C. Mehrotra, and C. Srikarni, "Fossil wood flora from the sivalik group of Arunachal Pradesh, India and its climatic and phytogeographic significance," *Journal of Earth System Science*, vol. 127, no. 1, 2018, doi: 10.1007/s12040-017-0903-2.
- [20] S. K. Malik, R. Chaudhury, R. K. Kalia, and E. Dulloo, "Seed storage characteristics and cryopreservation of genetic resources of tropical underutilized fruits in India," in *Acta Horticulturae*, 2011. doi: 10.17660/ActaHortic.2011.918.23.
- [21] V. J. Khilari, S. S. Gholap, and P. P. Sharma, "STUDIES ON CARBOHYDRATE AND PROTEIN CONTENTS OF SOME UNDERUTILIZED WILD FRUITS," *European Journal of Biomedical and Pharmaceutical Sciences*, vol. 3, no. 11, 2016.
- [22] R. Yadav, A. Suthar, K. Tatu, R. D. Kamboj, and R. K. Sugoora, "A Record of Parthenocarpic Character in Fruit of *Diospyros melanoxylon* Roxb.," *Indian Forester*, vol. 149, no. 4, 2023, doi: 10.36808/if/2023/v149i4/162478.
- [23] D. Roy, K. Das, P. Nandi, S. Kundu, B. Ghosh, and A. A. Sharath, "Kendu - A promising underutilized forest fruit species for poverty alleviation of tribals," *Acta Hort*, vol. 1241, 2019, doi: 10.17660/ACTAHORTIC.2019.1241.103.
- [24] V. K. Prasad, T. Rajagopal, K. Yogesh, and K. V. S. Badarinath, "Quantification of nutrient dynamics after fire in tropical dry deciduous forests (Eastern Ghats)," *Van Vigyan*; 1998, publ. vol. 36(2/3/4), no. 2/3/4, 1998.
- [25] J. S. Singh and K. D. Singh, "Silviculture of Dry Deciduous Forests, India," 2011. doi: 10.1007/978-3-642-19986-8\_18.

- [26] K. P. Singh, "Mineral nutrients in tropical dry deciduous forest and savanna ecosystems in India," *Mineral nutrients in tropical forest and savanna ecosystems*, 1989.
- [27] P. R. N., J. A. A., and P. B. H., "Pharmacognostical and Preliminary Phytochemical Studies of *Diospyros Melanoxylon* Roxb. Leaf.," *Journal of Current Pharma Research*, vol. 2, no. 4, 2012, doi: 10.33786/jcpr.2012.v02i04.005.
- [28] P. R. N., J. A. A., and P. B. H., "Pharmacognostical and Preliminary Phytochemical Studies of *Diospyros Melanoxylon* Roxb. Leaf.," *Journal of Current Pharma Research*, vol. 2, no. 4, 2012, doi: 10.33786/jcpr.2012.v02i04.005.
- [29] S. Singh, R. Pandey, and R. Das, "Estimation of *Diospyros melanoxylon* Roxb. Leaves Production in Forests of Jharkhand, India," *Asian Plant Research Journal*, vol. 11, no. 6, 2023, doi: 10.9734/aprj/2023/v11i6226.
- [30] V. Gupta, V. Maitili, and P. K. Vishwakarma, "Comparative study of analgesic activity of *Diospyros melanoxylon* (Roxb.) bark and root bark," *Journal of Natural Remedies*, vol. 13, no. 1, 2013.
- [31] S. Biswas and D. K Khan, "Nutrient Use Pattern of *Diospyros Melanoxylon* in Comparison to *Shorea Robusta* in Fragmented Dry Tropical Forest in West Bengal, India," *Journal of Environment and Ecology*, vol. 3, no. 1, 2012, doi: 10.5296/jee.v3i1.2327.
- [32] J. K. Jadhav, V. J. Masirkar, V. N. Deshmukh, R. B. Wakade, A. A. Harsulkar, and D. M. Sakarkar, "Antidiabetic activity of *Diospyros melanoxylon* (roxb.) bark against alloxan-induced diabetes in rats," *Indian Drugs*, vol. 48, no. 3, 2011.
- [33] D. Churpal, S. S. Tuteja, A. K. Gauraha, and H. Pathak, "Economically and traditionally important non- timber forest products (NTFPs) of Chhattisgarh," *J Pharmacogn Phytochem*, vol. 10, no. 1, 2021.
- [34] W. Qamar, T. H. Khan, and S. Sultana, "Toxic wrapper of bidi : The unobserved part of a handmade cigarette," *Bioscience Discovery*, vol. 4, no. 2, 2013.
- [35] B. Z. Hmar, S. Mishra, and R. C. Pradhan, "Design, fabrication, and testing of a pulper for Kendu (*Diospyros melanoxylon* Roxb.)," *J Food Process Eng*, vol. 41, no. 1, 2018, doi: 10.1111/jfpe.12642.
- [36] S. A. Paul and S. K. Chavan, "Waste tendu leaves from beedi industry utilized for removal of sulphur dye from textile waste water," *Oriental Journal of Chemistry*, vol. 28, no. 1, 2012, doi: 10.13005/ojc/280156.
- [37] M. M. Ekka, L. Arya, and B. C. Patel, "A systematic evaluation of 'Bidi – a hand-rolled cigarette' as a forensic DNA evidence," *Forensic Sci Int*, vol. 324, 2021, doi: 10.1016/j.forsciint.2021.110821.
- [38] V. M. Patil, A. Mandal, S. Tomar, L. Kumar, and N. Masand, "Phytochemical and Pharmacological Profile of *Diospyros melanoxylon*," *Nat Prod J*, vol. 7, no. 4, 2017, doi: 10.2174/2210315507666170810155154.
- [39] K. Mohan Kisku, P. Mandal, S. Ghosh, and P. Sarathi De, "Green Synthesis of Poly(vinyl alcohol)-Silver Nanoparticles Composite Using Kendu (*Diospyros melanoxylon* Roxb) Fruit Peel Extract and Its Antibacterial Activity," *ChemistrySelect*, vol. 8, no. 43, 2023, doi: 10.1002/slct.202303455.
- [40] S. Panda, D. Dubey, and S. Dutta, "Anticandidal activity of *diospyros melanoxylon* Roxb. Bark from simlipal biosphere reserve, Orissa, India," *International Journal of Green Pharmacy*, vol. 4, no. 2, 2010, doi: 10.4103/0973-8258.63885.
- [41] K. A. Supriya and L. Growther, "IN-VITRO ANTIOXIDANT AND ANTIBACTERIAL ACTIVITY OF DIFFERENT EXTRACTS OF *DIOSPYROS MELANOXYLON ROXB*," *Int J Pharm Sci Res*, vol. 10, no. 4, 2019.
- [42] R. N. Maru and R. S. Patel, "Ethno-Botanical Survey of Sacred Groves and Sacred Plants of Jhalod and Surrounding Areas in Dahod District , Gujarat , India," *Res J Recent Sci*, vol. 2, 2013.
- [43] A. Mhaskey et al., "Collection and Marketing of Tendu Leaves in Rajasthan, India," *Asian Journal of Agricultural Extension, Economics & Sociology*, vol. 41, no. 10, 2023, doi: 10.9734/ajaees/2023/v41i102165.
- [44] S. K. Panda, Y. K. Mohanta, L. Padhi, Y. H. Park, T. K. Mohanta, and H. Bae, "Large scale screening of ethnomedicinal plants for identification of potential antibacterial compounds," *Molecules*, vol. 21, no. 3, 2016, doi: 10.3390/molecules21030293.
- [45] H. N. Thatoi, S. K. Panda, S. K. Rath, and S. K. Dutta, "Antimicrobial activity and ethnomedicinal uses of some medicinal plants from Similipal Biosphere Reserve, Orissa," *Asian J Plant Sci*, vol. 7, no. 3, 2008, doi: 10.3923/ajps.2008.260.267.
- [46] K. Rathore, V. K. Singh, P. Jain, S. P. Rao, Z. Ahmed, and V. D. Singh, "In-vitro and in-vivo antiadipogenic, hypolipidemic and antidiabetic activity of *Diospyros melanoxylon* (Roxb)," *J Ethnopharmacol*, vol. 155, no. 2, 2014, doi: 10.1016/j.jep.2014.06.050.
- [47] R. K. Upadhyay, "Antimicrobial Activity of Fruit Latexes from Ten Laticiferous Plants," *Am J Plant Sci*, vol. 06, no. 03, 2015, doi: 10.4236/ajps.2015.63053.
- [48] S. K. Rath, N. Mohapatra, D. Dubey, S. K. Panda, H. N. Thatoi, and S. K. Dutta, "Antimicrobial activity of *Diospyros melanoxylon* bark from Similipal Biosphere Reserve, Orissa, India," *Afr J Biotechnol*, vol. 8, no. 9, 2009.

- [49] S. Sahu, S. Pahi, J. K. Sahu, U. K. Sahu, and R. K. Patel, "Kendu (*Diospyros melanoxylon* Roxb) fruit peel activated carbon—an efficient bioadsorbent for methylene blue dye: equilibrium, kinetic, and thermodynamic study," *Environmental Science and Pollution Research*, vol. 27, no. 18, 2020, doi: 10.1007/s11356-020-08561-2.
- [50] Z. Jamil, A. M. Mohite, and N. Sharma, "Selected engineering properties and drying behavior of tendu (*Diospyros melanoxylon* roxb.) fruit," *Current Research in Nutrition and Food Science*, vol. 8, no. 2, 2020, doi: 10.12944/CRNFSJ.8.2.27.
- [51] A. N. D. E. Kiran Kumar et al., "Evaluation of anti ulcer activity of ethanol extract of *diospyros melanoxylon* (roxb). bark," *Int J Pharm Pharm Sci*, vol. 4, no. 4, 2012.
- [52] J. Patel, V. Reddy, and G. S. Kumar, "Evaluation of hepatoprotective activity of ethanolic extract of *Diospyros melanoxylon* (Roxb) leaves against CCl<sub>4</sub> induced hepatotoxicity in albino rats," *Res J Pharm Technol*, vol. 8, no. 5, 2015, doi: 10.5958/0974-360X.2015.00095.5.
- [53] M. H. Al Rashid, P. V. P. D. Bharadwaj, V. Mandal, M. Pal, S. C. Mandal, and R. A. Thandavarayan, "Preparation and characterization of PLGA loaded nanoparticles obtained from *D. Melanoxylon* Roxb. Leaves for their antiproliferative and antidiabetic activity," *International Journal of Green Pharmacy*, vol. 11, no. 3, 2017.
- [54] K. Rathore, V. K. Singh, P. Jain, S. P. Rao, Z. Ahmed, and V. D. Singh, "In-vitro and in-vivo antiadipogenic, hypolipidemic and antidiabetic activity of *Diospyros melanoxylon* (Roxb)," *J Ethnopharmacol*, vol. 155, no. 2, 2014, doi: 10.1016/j.jep.2014.06.050.
- [55] R. K. Gupta and P. S. Rao, "Chemical examination of the leaves of *Diospyros melanoxylon* Roxb.," *Proceedings of the Indian Academy of Sciences - Section A*, vol. 60, no. 1, 1964, doi: 10.1007/BF03046367.
- [56] G. Ramakrishna, S. Chukka, and S. Puligilla, "Evaluation of analgesic, anti-inflammatory and anti-ulcer activity of *Diospyros melanoxylon* (RoBX). Methanolic leaf extract in rats and mice," *Int. J Pharm Sci Rev Res*, vol. 24, no. 2, 2014.
- [57] J. S. Rathore, "*Diospyros melanoxylon*, a bread-winner tree of India," *Econ Bot*, vol. 26, no. 4, 1972, doi: 10.1007/BF02860703.
- [58] S. D. Jagtap, S. S. Deokule, P. K. Pawar, A. A. Kuvalekar, and A. M. Harsulkar, "Antimicrobial activity of some crude herbal drugs used for skin diseases by Pawra tribes of Nandurbar district," *Indian J Nat Prod Resour*, vol. 1, no. 2, 2010.
- [59] V. K. Palakurthi et al., "Phytochemical screening and anti-oxidant property of *Diospyros melanoxylon* used by Gothi Koya and Konda Reddi Tribes of Kinnerasani Wildlife Sanctuary, Paloncha, Bhadradi Kothagudem district, Telangana," *Journal of Medicinal Plants Studies*, vol. 10, no. 6, 2022, doi: 10.22271/plants.2022.v10.i6a.1486.
- [60] D. P. Saxena et al., "Efficacy Studies of in vitro Screening of Antiplasmodial Activity by Crude Extracts of *Diospyros melanoxylon*," *Research Journal of Medicinal Plant*, vol. 5, no. 3, 2011, doi: 10.3923/rjmp.2011.312.320.
- [61] M. V. Rao, R. Sundararaj, A. V. Pachu, and R. R. Shanbhag, "Deterioration of imported timber by marine borers along Visakhapatnam tropical harbour, India," *Int Biodeterior Biodegradation*, vol. 109, 2016, doi: 10.1016/j.ibiod.2015.12.024.
- [62] C. Kamaraj, A. A. Rahuman, A. Mahapatra, A. Bagavan, and G. Elango, "Insecticidal and larvicidal activities of medicinal plant extracts against mosquitoes," *Parasitol Res*, vol. 107, no. 6, 2010, doi: 10.1007/s00436-010-2006-8.
- [63] K. K. Rout, R. K. Singh, and S. K. Mishra, "Simultaneous quantification of two bioactive lupane triterpenoids from *Diospyros melanoxylon* stem bark," *Journal of Planar Chromatography - Modern TLC*, vol. 24, no. 5, 2011, doi: 10.1556/JPC.24.2011.5.3.
- [64] U. V. Mallavadhani, A. K. Panda, and Y. R. Rao, "Triterpene acids from *Diospyros melanoxylon*," *Biochem Syst Ecol*, vol. 26, no. 8, 1998, doi: 10.1016/S0305-1978(98)00061-1.
- [65] M. K. Durgam, P. K. Vemuri, V. L. Bodiga, and S. Bodiga, "Lupenone Isolated from *Diospyros melanoxylon* Bark Non-competitively Inhibits alpha-amylase Activity," *Biology, Medicine, & Natural Product Chemistry*, vol. 12, no. 1, 2023, doi: 10.14421/biomedich.2023.121.171-176.
- [66] S. Kanta Rath, J. Kumar Patra, S. Gouda, S. Kumar Sahoo, H. Thatoi, and S. Kumar Dutta, "Evaluation of Antioxidant Potential, Phytochemical Analysis and Chromatographic Separation of Bark Extracts of *Diospyros melanoxylon* Roxb," *Journal of Biologically Active Products from Nature*, vol. 4, no. 5–6, 2014, doi: 10.1080/22311866.2014.957102.
- [67] A. V. B. Sankaram and G. S. Sidhu, "A new naphthaldehyde from the heartwood of *Diospyros melanoxylon*," *Phytochemistry*, vol. 10, no. 2, 1971, doi: 10.1016/S0031-9422(00)94077-9.
- [68] A. V. B. Sankaram, V. V. Narayana Reddy, and G. S. Sidhu, "A pentacyclic quinone diosindigo B from the heartwood of *Diospyros melanoxylon*," *Phytochemistry*, vol. 20, no. 5, 1981, doi: 10.1016/0031-9422(81)83034-8.
- [69] U. V. Mallavadhani, A. K. Panda, and Y. R. Rao, "*Diospyros melanoxylon* leaves: A rich source of pentacyclic triterpenes," *Pharm Biol*, vol. 39, no. 1, 2001, doi: 10.1076/phbi.39.1.20.5941.
- [70] K. K. Rout, B. Dash, and R. K. Singh, "HPTLC Quantification and Antimicrobial Activity of Ursolic Acid from *Diospyros melanoxylon*," *Journal of Planar Chromatography - Modern TLC*, vol. 25, no. 4, 2012, doi: 10.1556/JPC.25.2012.4.7.



- [71] Md. H. Al Rashid et al., "ANTIOXIDANT AND ANTICANCER ACTIVITY OF EXTRACT AND FRACTIONS OBTAINED FROM DIOSPYROS MELANOXYLON ROXB. LEAVES AND CORRELATION WITH THEIR POLYPHENOLIC PROFILES," *Int J Pharm Pharm Sci*, vol. 10, no. 11, 2018, doi: 10.22159/ijpps.2018v10i11.21111.
- [72] A. Kumar and S. H. Puttaiah, "Isolation and characterization of p-Coumaric acid from Diospyros melanoxylon medicinal plant endemic to Western Ghats, India," *J Adv Environ Health Res*, vol. 7, 2019.
- [73] P. R. N., J. A. A., and P. B. H., "Assessment of In Vitro Cytotoxicity of Diospyros Melanoxylon Roxb. Leaf Using Brine Shrimp Assay," *Journal of Current Pharma Research*, vol. 2, no. 4, 2012, doi: 10.33786/jcpr.2012.v02i04.007.
- [74] V. M. Patil and N. Masand, "In vivo acute and subchronic toxicity studies of methanolic extract obtained from roots of Diospyros melanoxylon L.," *Proceedings for Annual Meeting of The Japanese Pharmacological Society*, vol. WCP2018, no. 0, 2018, doi: 10.1254/jpssuppl.wcp2018.0\_po3-13-30.
- [75] D. N. Tewari, *Tropical forest produce*. 1994.
- [76] R. Kumar and P. Saikia, "Forest resources of Jharkhand, Eastern India: Socio-economic and bio-ecological perspectives," in *Environmental Science and Engineering*, 2020. doi: 10.1007/978-3-030-32463-6\_4.
- [77] R. S. Khatavkar, N. V. Shah, M. D. Chavan, and K. R. Rao, "Production of vermicompost from leaf litter generated by beedi (hand made Indian cigarette industry)," *Asian Journal of Microbiology, Biotechnology and Environmental Sciences*, vol. 10, no. 1, 2008.
- [78] G. K. Nagda and V. S. Ghole, "Utilization of lignocellulosic waste from bidi industry for removal of dye from aqueous solution," *Int J Environ Res*, vol. 2, no. 4, 2008.
- [79] A. Jain, C. Taksande, and G. Rajeshwar Rao, "EFFECT OF PRUNING AND FERTILIZER APPLICATION ON THE QUALITY OF Diospyros melanoxylon LEAVES IN CHHATTISGARH (INDIA)," *Appl Biol Res*, vol. 22, no. 3, 2020, doi: 10.5958/0974-4517.2020.00039.7.
- [80] S. K. Pandey, H. Singh, and J. S. Singh, "Effect of Environmental Conditions on Decomposition in Eight Woody Species of a Dry Tropical Forest," *Plant Biosyst*, vol. 148, no. 3, 2014, doi: 10.1080/11263504.2013.772923.
- [81] R. S. Khatavkar, N. V. Shah, K. R. Rao, M. D. Chavan, and L. C. Mushan, "Vermicomposting of beedi Indian Cigarette leaf litter and its bioadsorbant utility," *Ecology, Environment and Conservation*, vol. 14, no. 4, 2008.