



PHARMACOLOGICAL ACTIVITIES OF *DIOSPYROS MESPILIFORMIS*: A REVIEW

*Ahmed A.H¹ and Mahmud A.F²

¹Department of Pharmacognosy and Ethnomedicine, Faculty of Pharmaceutical Sciences, Usmanu Danfodiyo University, Sokoto- Nigeria

²Department of Pharmacognosy and Drug Development, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria-Nigeria

*Corresponding Author Email: aliyuhameedahmed@gmail.com

ABSTRACT

Diospyros mespiliformis commonly known as African ebony is a large deciduous tree belonging to the family Ebenaceae in the order Ebenales found mostly in Tropical and Sub-Saharan Africa. It has a wide range of Ethnomedicinal uses some of which have been substantiated scientifically. Traditionally, it is used as astringent, febrifuge, hemostatic, mild laxative, stimulant and vermifuge and to facilitate child birth. Studies on *Diospyros mespiliformis* reveal the presence of a number of important phytochemicals. According to the literature review it has numerous pharmacological activities including; anticancer, analgesic, anti-inflammatory, hypoglycemic, Antiplasmodial and anti-oxidant. The various pharmacological and Ethnomedicinal information found in various researches might be useful in development of new drugs.

KEY WORDS

Diospyros mespiliformis, Ethnomedicinal, African ebony, Ebenaceae, Pharmacological

Introduction

Diospyros mespiliformis Hoschst ex A. DC a large deciduous tree found mainly in the savannas of Africa [1]. It is a tall tree that grows up to 25 meters in height. It has a dense evergreen canopy [2]. *Diospyros Mespiliformis* has been used in Traditional Medical systems including Ayurveda, Chinese and African [3]. The plant is widely used in parts of Africa and a number of chemical constituents of therapeutic importance have been isolated [4]. *Diopyros mespiliformis* has a large range of medicinal uses [5, 6]. A traditional food plant in Africa, the fruit has potential to improve nutrition. This review article is aimed at compiling updated information on the pharmacological activities, phytochemical constituents and Ethnomedicinal uses.

2. Common names [4]

The common names of *Diospyros mespiliformis* include;

- African Ebony
- Jackelberry

- Monkey Guava
- Persimmon
- Swamp Ebony
- West African Ebony

3. Local names [7]

- Arabic: Jukham
- Fulani: Nelbi
- Hausa: Kanya
- Isala: Obiudu
- Kanuri: Bergem
- Yoruba: Kanram, Igidudu

4. Taxonomical Classification [8]

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Superdivision: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida

- Subclass: Dilleniidae
- Order: Ebenales
- Family: Ebanaceae
- Genus: *Diospyros*. L
- Specie: *mespiliformis* Hochst. ex A. DC.
- **Synonyms:**
Diospyros sabiensis Hiern, *Diospyros senegalensis* Perr. ex A. DC

5. Plant Description

Diospyros mespiliformis is a tall, evergreen tree 15-50 m high, with dense, rounded and buttressed stem. Bark grey-black or black, smooth in young trees rough with small regular scales in older trees, pinkish when slashed. Young branchlets are green, tomentellous with pinkish white hairs, glabrescent later. Crown is very branchy with dense foliage. Fruits are usually globose, fleshy, greenish and pubescent when young, yellowish to orange yellow and glabrous when ripe, bell shaped, with persistent style and enlarged calyx and contain 4-6 seeds. Seeds are dark brown, bean-shaped shiny and glabrous. Flowers are pentamerous, white and fragrant. Male flowers are sessile hairy and clustered on axillary peduncles. Female flowers are solitary, shortly pediculate and axillary with 5-lobed calyx [9]. The leaves are simple, alternate, leathery and dark green with small hairs on the underside of old leaves [10]. The fruit is a fleshy berry, with an enlarged calyx yellow to orange when ripe [11].

6. Ethnomedicinal Uses

Leaves: Used as astringent, febrifuge, hemostatic, mildly laxative, stimulant and vermifuge. Infusion of the leaves is used in treatment of fevers, pneumonia, syphilis, leprosy and yaws [12]. The leaves are also used for treatment of headache, arthritis and skin infections. The leaves and fruits are chewed or applied as infusion for treating gingivitis, toothache, and for wound dressing to prevent infection [4]

Root and Bark: an infusion of the bark is used to treat stomach ache [13]. Bark and roots for infections such as malaria, pneumonia, syphilis, leprosy, dermatomycoses, as an anthelmintic and to facilitate child birth [9]. Barks and roots are used as psycho-pharmacological drug and to treat tumor [14]. Roasted and pulverized roots are taken to treat jaundice; Bark preparations are administered to treat cough, bronchial diseases, tuberculosis, syphilis and leprosy, and applied externally

to wounds, ulcers, bruises and furuncles. The bark is also used in veterinary medicine as vermifuge [15].

Fruits and Seeds: Fruits decoction or infusions are taken to treat dysentery, diarrhea, and menorrhagia. Fruit ash is applied to fungal skin infections and fruit powder to ulcers, whereas seed decoctions are administered against headache. Twigs are chewed to clean teeth [15]. Its seeds are also known to have nutraceutical value in managing high cholesterol, reducing risk of type-2 diabetes, and for weight control [16].

7. Phytochemical Constituents

Phytochemical plumbagin is isolated from rook-bark. Tannins, saponins and substances similar to scopolamine are present. It also has high fluoride content [4]. Studies on *Diospyros mespiliformis* has revealed the presence of triterpenes, α -amyrin-baurenol, trihydroxy-triterpenoid acid, α -amyrin, β -sitosterol, lupeol, betulin, behenic acid, and naphthoquinones like; Diospyrin, Isodiospyrin, Diosquinone, plumbagin [14]. Preliminary phytochemical screening also revealed the presence of several secondary metabolites namely; anthraquinones, tannins, triterpenes, saponins, steroids. [17].

8. Pharmacological Uses

8.1 Antioxidant activity

Mohammed et al., 2016[18] investigated the in-vitro antioxidant using DPPH assay, total phenolic, and total flavonoid content of methanol, ethanol and petroleum ether leaf extracts of *Diospyros mespiliformis*. The methanol extract of *D. mespiliformis* were found to contain higher amount of phenolic, and flavonoid compounds.

8.2 Anti-proliferative effect

Abba et al., 2016 [19] reported anti-proliferative property of *Diospyros mespiliformis* stem bark extracts against radicles of a Guinea corn (*Sorghum bicolor*) which relate to its use as anticancer agent.

8.3 Antimicrobial activity

Shagal et al., 2011 [20] investigated the antimicrobial activity of aqueous and ethanol extracts of leaves, stem-bark and root of *Diospyros mespiliformis*. Activity of the extracts was tested against clinical isolates of *Salmonella typhi*, *Escherichia coli*, *Staphylococcus aureus*, *Streptococcus* spp, *Shigella sp* and *Klebsiella pneumonia*. *Staphylococcus aureus* was sensitive to ethanol extract of the leaves. The methanolic and water

extract of *Diospyros mespiliformis* showed significant antimicrobial activity against the tested microorganisms. Antibacterial activity of ethanol and water extracts of *Diospyros mespiliformis* was carried out by Dangoggo et al., 2016 [21]. The test organisms included clinical isolates of *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Streptococcus pyogenes*, *Salmonella typhi*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Shigella spp.* Antibacterial activity of crude extract of the leave of ethanol of *Diospyros Mespiliformis* produced zone of inhibition of 12mm, 14 mm on *E. coli* at 90 mg/ml and 120 mg/ml concentration respectively and 12mm and 13 mm on *P. aeruginosa* at 90 and 120 mg/ml respectively. There was no zone of inhibition on *Salmonella typhi*. For the water extract, it produced zone of inhibition of 10mm, 11mm, 12mm, 13mm on *S. aureus* at 30mg/ml, 60mg/ml, 90mg/ml and 120mg/ml concentrations respectively and 11mm, 13 mm on *P. aeruginosa* and also 11mm, 14 mm on *E. coli* at 90mg/ml, 120mg/ml, on *Shigella spp* 10mm, 11mm at 90mg/ml and 120mg/ml. The ethanol extract of *Diospyros mespiliformis* leaf showed significant activity on *E. coli*, *S. aureus*, *Shigella spp* and *P. aeruginosa*. The leaf and bark extract of *Diospyros mespiliformis* showed significant antifungal activity against *Aspergillus niger*, *Aspergillus flavus* and *Microsporum gypseum* at various concentration [22].

8.4 Antiplasmodial activity

In-vivo Antiplasmodial Activity of Aqueous, N-Butanol and Ethylacetate Fractions of Leaf and Stem Bark Methanol Extracts of *Diospyros mespiliformis* was tested on *Plasmodium berghei* Infected Mice by Oguiche, 2012 [23]. The results indicated that the leaf and stem bark methanol extracts of *Diospyros mespiliformis* are significantly effective against *Plasmodium berghei* could be used in the management of malaria.

8.5 Analgesic activity

The methanol extract of *Diospyros mespiliformis* was evaluated for its folkloric usage in the relief of pain and fever. Antipyretic, analgesic and anti-inflammatory effect of the extracts were evaluated in rats and mice. Studies were carried out on yeast induced pyrexia in rats; acetic acid induced writhing in mice, formalin test and egg albumin-induced anti-inflammatory activity in rats. The extract (50 and 100mg/kg i.p) gave a potent antipyretic effect for 100mg/kg and significant activity

($p < 0.05$) against all the analgesic and anti-inflammatory models used [24] Adzu et al., 2015 [25] extracted and carried out a bioassay-guided fractionation of the stem bark of *Diospyros mespiliformis* with solvents of varying polarity. Lupeol was isolated from the stem bark. This compound alone or synergistically might be responsible for the beneficial effect of the plant in treatment of pain related ailments.

8.6 Hypoglycemic activity

Mohammed et al., 2009 [14] carried out α -glucosidase enzyme inhibition activity of isolated bioactive compounds from *Diospyros mespiliformis*. The compounds were identified as lupane type triterpenes; lupeol, betulinic acid, betulin and lupenone. Lupeol, betulin and lupenone showed potent α -glucosidase inhibitory activity.

8.7 Neuropharmacological activity

The aqueous extract of *Diospyros mespiliformis* stem bark in mice (100 and 200 mg/kg p.p.) produced a significant prolongation of pentobarbital-induced sleeping time and reduced the spontaneous motor activity and exploratory behavior. The extract prolonged onset of the phases of seizure activity but did not protect mice against lethality induced by pentyletetroazole [24]

CONCLUSION

Diospyros mespiliformis has a wide range of Pharmacological activities and Ethnomedicinal uses. According to the literature review, it can serve as a potential source of anticancer, analgesic, anti-inflammatory, hypoglycemic, Antiplasmodial and antioxidant. The various pharmacological and Ethnomedicinal properties found in various researches might be useful in development of new drugs.

Reference

1. National Research Council (NRC) (2008). Lost crops of Africa Volume III: Fruits. National Academic press pp. 1-5
2. Belemtougri, R.G., Constantin, B., Cognard, C., Raymond, G. and Sawadogo L. (2006). Effects of two medicinal plants, *Psidium guajava* L. (Myrtaceae) and *Diospyros mespiliformis* L. (Ebenaceae) leaf extracts on rat skeletal muscle cells in primary culture. *Journal of Zhejiang University*; 7(1): 56-63.
3. Mallavadhni UV, Panda AK, Rao YR (1998). Pharmacology and chemotaxonomy of *Diospyros*. *Phytochemistry*; 49:901-51.

4. Burkill, H.M 1995. The Useful Plants of West Tropical Africa, Volume 1.
5. Etkin NL (1997) Antimalarial Plants used by Hausa in northern Nigeria. *Tropical Doctor*; 27(1):12-16.
6. Kerharo Adam JG (1974). Pharmacopée sénégalaise traditionnelle, plantes médicinales et toxiques. Vigot et Frères; Paris, 1011.
7. Shagal, M.H., Kubmarawa, D. & Alim, H. (2012) Preliminary phytochemical investigation and Antimicrobial evaluation of roots, stem-bark and leaves extracts of *Diospyros mespiliformis*. *International Research Journal of Biochemistry and Bioinformatics* (ISSN-2250-9941) Vol. 2(1) pp.011-015 January 2012
8. USDA, NRCS, 2017. The Plants Data Base (<http://plants.usda.gov>, 21 August 2017) National Plant Data Team, Greensboro, NC 27401-4901 USA.
9. Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony (2009). Agroforestry Database: a tree reference and selection guide version 4.0 (http://www.worldagroforestry.org/sites/treedbs/tree_databases.asp)
10. National Research Council (NRC) (2008). Lost crops of Africa Volume III: Fruits. National Academic press pp. 1-5
11. Thompson Mutsinyalo, Walter Sisulu National Botanical Garden August 2007.
12. Von Maydell H. 1990, Deutsche Gesellschaft für Technische Zusammenarbeit; Germany, ISSN: 3-8236-1198-4
13. Ruffo, C.K., Birnie, A & Tengnas, B. Regional Land Management Unit Nairobi 2002. 9966-896-60-0.
14. Mohamed IE, El Nur EE, Choudhary MI, Khan SN (2009). Bioactive natural products from two Sudanese medicinal plants *Diospyros mespiliformis* and *Croton zambesicus*. *Rec. Nat. Prod.*; 3:198-203.
15. El-Kamali, H.H., 2011 *Diospyros mespiliformis* Hochst ex A.D.C. [Internet] Record from PROTA4U. Lemmens, R.H.M.J, Louppe, D & Oteng-Amoako, A.A (Editors). PROTA (Plant Resources of Tropical Africa)/ Ressources végétales de l'Afrique tropicale, Wageningen, Netherlands. <http://www.prota4u.org/search.asp>.
16. Chivandi E, Erlwanger KH (2011). Potential usage of African Ebony (*Diospyros mespiliformis*) seeds in human health in: Nuts and Seeds in Health and Disease Prevention (Preedy VR, Watson RR, Patel VBEds.), Elsevier B.V., Amsterdam, Netherlands. pp. 147-152.
17. Adeniyi B.A, Odetola H.A, Oso B.A. Antimicrobial potentials of *Diospyros mespiliformis* (Ebenaceae) *Afr J Med Sci.* 1996; 25:221-224
18. Mohammed Abass A, Ahmed Kabbashi S, Suliman Suliman I, Amna Ali, Omer Salah, * Mohammed Garbi. *In vitro* Antioxidant Activity, Phytochemical analysis and Cytotoxicity of *Diospyros mespiliformis*. *International Journal of Botany Studies* ISSN: 2455-541X www.botanyjournals.com Volume 1; Issue 1; January 2016; Page No. 23-28
19. Abba, A., Agunu, A., Abubakar, A., Abubakar, U.S. And Jajere, M.U. Phytochemical Screening and Antiproliferative Effects of Methanol Extract of Stem Bark of *Diospyros mespiliformis* Hochst (Ebenaceae) Against Guinea Corn (*Sorghum Bicolor*) Seeds Radicles Length. *Bayero Journal of Pure and Applied Sciences*, 9(1): 1 – 5 Received: November 2015 Accepted: June 2016 Issn 2006 – 6996
20. Shagal M.H Kubmarawa. D and Alim. H (2011), Preliminary phytochemical investigation and antimicrobial evaluation of roots, stem-bark and leaves extracts of *Diospyros mespiliformis*. *International Research Journal of Biochemistry and Bioinformatics* (ISSN 2250-9941) Vol. 2(1) pp.011-015 January 2012 Available online <http://www.interesjournals.org/IRJBB>.
21. Dangoggo S.M. Hassan L. G, Sadiq I.S and Manga S.B (2016). Phytochemical Analysis and Antibacterial Screening of Leaves of *Diospyros mespiliformis* and *Ziziphus Spina-Christi* *International Journal of Biochemistry Research & Review* 12(4): 1-9, Article no. IJBCRR.21645 ISSN: 2231-086X, NLM ID: 101654445 SCIEDOMAIN international www.sciencedomain.
22. Dangoggo S.M., Hassan L.G., Sadiq I.S and Manga S.B (2013), Bioactive isolation and antifungal screening of leaf and bark of *Diospyros mespiliformis* and *Ziziphus spinida-christi*. *International journal of Traditional and Natural Medicines*, 2(2): 104-117
23. Oguche M., Nzelibe H.C (2012). *In-vivo* Antiplasmodial Activity of Aqueous, N-Butanol and Ethylacetate Fractions of Leaf and Stem Bark Methanol Extracts of *Diospyros mespiliformis* on *Plasmodium berghei berghei* (Nk65) Infected Mice *Journal of Chemical Engineering* Vol. 1, No. 1
24. Adzu, B Amos, S.; Muazzam, I.; Inyang, U.S.; Gamaniel, K.S (2003), Neuropharmacological screening of *Diospyros mespiliformis* in mice. *Journal of Ethnopharmacology* v. 83(1-2): p. 139-143, 2002 (Eng; 36 ref).
25. Adzu Bulus, Ben Ahmed Chindo, Florence David Tarfa, Oluwakanyinsola Adeola Salawu and Ogbaji John Igoli. Isolation and analgesic property of lupeol from *Diospyros mespiliformis* stem bark. Copyright © 2015 Author(s) retains the copyright of this article <http://www.academicjournals.org/IJMP>.

***Corresponding Author:**

Ahmed A.H*

Email: aliyuhameedahmed@gmail.com