



Brief Review of the Genus *Diospyros Montana* Roxb: Phytopharmacological Properties

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ABSTRACT

Diospyros montana Roxb. (F: Ebenaceae) commonly known as Ebony is a species of flowering tree native to India and other countries. These plant part as a whole in used in treatment of several diseases in particular, leaves and bark are used in folk medicine for the treatment of fish poison, anti-inflammatory, anti cancer etc. This present investigation reviews the bioactivity of flavonoids, phenols, carbohydrates, amino acids, protein, saponins, alkaloids, tannins, sterols, anthocyanin and anthraquinones, fixed oils and fats, and their presence in various parts of *Diospyros montana*. The significant constituent such as Diospyros, Isodiospyrin, Oleanolic acid, quercetin, β -amyrin and kaempferol have been isolated from various parts of the plant is discussed with a detailed description. The narrower approach indicates that *Diospyros montana* possess various pharmacological activities like antiviral, anticancer, antitumor, antimalarial, anthelmintic, prostaglandin synthesis inhibitory, anti-inflammatory, hypolipidemic, and antileukemic agent and several other important medicinal properties. This review focus on comprehensive and categorized information on the botany, traditional uses, phytochemistry and pharmacological aspects of *Diospyros montana* which provide valuable information to researchers for continuing further scientific work on this plant.

Keywords: *Diospyros montana*; Ebony; Phytochemical studies; Pharmacological aspects

1 Introduction

The traditional medicine based on plants rely a well relationship belonging to natural remedies and diet, for the benefit of human kind [1]. Traditional medicines are used by about 60% of the World's population. These are not only used for primary health cure just in rural areas of developing countries, but also in developed countries as well as where modern medicines are predominantly used [2]. The plant based traditional medicine is widespread in China, India, Japan, Pakistan, Sri Lanka and Thailand. Particularly, the Indian sub-continent has a very rich diversity of plant species and wide range of ecosystems. There are about 17000 species of higher plants of which approximately 8000 species are considered to possess medicinal values [3]. Ayurveda is the oldest medical system in the Indian sub-continent, it has reported approximately 2000 medicinal plant species followed by Siddha and Unani [4]. It is reported that, approximately 25% of drugs are derived from plants and many others are synthetic analogues built on prototype compounds isolated from plant species [5]. The Indian Traditional Medicine is one of the oldest systems and possess its own recognized traditional medicine (Ayurveda, Yoga, Unani, Homoeopathy and Siddha). Nowadays, these systems are used in basic treatment approach of all the pharmacological modalities which include plants, animals, or mineral origin which has helped the pandemic crisis in the past. Presently, some of the common Indian medicinal plants (*Allium sativum* L., *Cinnamomum verum* J. Presl., *Curcuma longa* L., *Linum usitatissimum* L., *Nigella sativa* L., *Ocimum sanctum* L., *Phyllanthus*



emblica L., Piper nigrum L., Tinospora cordifolia (Willd.) Miers, Withania somnifera (L.) Dunal and Zingiber officinale Roscoe) have been explored against COVID-19 [6].

Plants are used in traditional healing by different cultures and have a long history of ancestors creating primitive medicine during their struggle against natural calamities and diseases. Medicinal plants contain metabolites which are important sources of drugs against many diseases. Hence, people believe that natural drugs are safer than synthetic ones [7]. Generally medicinal plants are rich source of antioxidant compounds such as alkaloids, phenolics, quinones, flavonoids, coumarins and vitamins, which can decrease the incidence of oxidative stress and associated diseases [8]. A majority of antioxidants are naturally present in food and drinks. If they are consumed regularly and examined systematically it can prevent diseases like cancer, heart disease and general sickness [9]. The use of medicinal plants has increased during COVID pandemic and most of the respondents recommended medicinal plants to prevent COVID-19 [10].

The WHO (World Health Organization) estimates that around 85 – 90 % of the World's inhabitants consumed traditional medicines and also recommended the assessment of plants for effectiveness against human diseases [11]. The traditional medicine is widespread around 80% in the world and inhabitants are essentially utilized for primary health care [12]. Developing countries (Tanzania-60 %, Rwanda-70%, India-70%, and Benin-80%) and developed countries (Belgium-31%, USA-42%, France-49%, and Canada-70%) use traditional medicine for primary health [13]. Renewed system of indigenous medicine (Ayurvedha, Siddha and Unani) was originated in India. [14]. India has a wealthy natural heritage resource with the points of view of safety, efficacy, and quality that will encourage to safeguard the use of natural products in healthcare [15]. This tradition has survived for more than 3000 years, mainly using plant-based drugs [16]. For many centuries, the use of medicinal plants has become a main part of daily life despite the development in medical and pharmaceuticals research area [17].

All the available information of *Diospyros montana* Roxb was collected via electronic search (using Pubmed, SciFinder, Scirus, Google Scholar, and Web of Science) and a library search for articles published in peer-reviewed journals.

2 Ebenaceae Family

The Ebenaceae are a family of flowering plants and includes ebony and persimmon among 768 species. It is distributed across the tropical and warmer temperate regions of the world and most diverse in the rainforests of Malaysia, India, tropical Africa and America. The Ebenaceae family approximately 500 species are trees and shrubs and 6 genera like *Diospyros*, *Euclea*, *Onothea*, *Royena*, *Rhaphidanthe*, *Maba*, and *Tetraclis*. The family has species of trees and bushes in two genera, *Diospyros* and *Euclea* which are widespread mostly in tropics and subtropics [18].

3 *Diospyros* genus

The genus *Diospyros* is comprised of about 500 species, distributed in the tropical and temperate zone [19]. The *Diospyros* are commonly known as persimmon or ebony with more than 249 species is economically most important and majority of *Diospyros* are native to the tropics [20]. This is growing in subtropical and tropical areas of the China, India, Indonesia, and the Malay Peninsula. A number of *Diospyros* species are reputed for their local herbal medicinal uses (Chinese herbal medicine, Tibetan medicine and Ayurvedic medicine) [21]. Ethnopharmacologically various plant parts are formulated and prescribed in the form of extracts and the decoctions for remedy of different diseases in many tribes. In the treatment of asthma, abdominal pains, dysentery, leprosy, whopping cough, menstrual troubles and as antibiotics several parts of this plant genus have been used since a long time [22].

4 *Diospyros montana* Roxb

Diospyros montana Roxb is one of the medicinally essential plant because all parts of *Diospyros montana* possess excellent therapeutic value in traditional system of medicine. *Diospyros montana* economically useful medicinal plant of Ebenaceae family [23]. This plant is a naturally occurring tree of deciduous forest and

widely distributed throughout India and it receiving increased attention as it is used in Indian traditional medicines (Ayurveda and Unani) [24]. The poisonous plants have many chemical constituents. It is poisonous used in various purposes i.e., weapons, in controlling pests and medicines on the basis its constituent properties. Poisonous plants occur in great variety (higher plants and lower groups) in tropical regions [23]. *Diospyros montana* contain various phytochemicals such as phenols, flavonoids, saponins, terpenoids and reducing sugars and etc [25]. The literature also revealed that phytochemicals of this species possesses some imperative significant pharmacological activities, used in the treatment of cough, ulcer, anti-hypersensitive and snake bites [26,27]. This plant comprises an extensive variety of structurally varied secondary metabolites and to support its traditional uses with scientific evidences.

5 Scientific classification

| | |
|---------|----------------------------|
| Kingdom | : Plantae |
| Order | : Ericales |
| Family | : Ebenaceae |
| Genus | : Diospyros |
| Species | : <i>Diospyros montana</i> |

Common Name: Dheki, Makrol, Bombay Ebony

Tamil : Karunthuvalisu, Vakanai, Vakkanatthi

English : Mountain persimmon, mottled ebony

Other Indian : Bistendu, Jagalkanti, Manjakara, Bankini, Vakkanai, Malayakathitholi Manjakara, Nanchimaram, Bali, Malayakathitholi.

5.1 Habitat

A small armed tree with slim stem and smoothbark dark grey, rough uneven. The leaves are alternate, ovate to oblong or ovate to lanceolate, almost glabrous and flowers are creamy-white corolla with light brown markings, axillary males in cymes of 3, female solitary. Fruit is drupe globose, green when young, yellow when ripe and fall down to become dark brown colour. The plant blooming time is February-July.

5.2 Significance

The plant parts are naturally used by the ayurvedic practitioner in India to treat various ailments such as fever, dysuria, gravel, neuralgia and etc. Particularly crushed leaves used as fish poison and bark extract is significant anti-inflammatory, antipyretic and analgesic [23]. *Diospyros montana* has been accounted to possess anthelmintic, anticancer, anti-inflammatory and etc. In Indian ethnomedicinal, this plant bark is used in therapy of jaundice and gum and is prescribed in tuberculosis while roots are used as an abortifacient [28,18].

6 Phytochemical properties

Diospyros montana Roxb, the valuable plant is recognized medicinally potent based on the occurrence of phytochemicals like as flavonoids, carbohydrates, steroids, and triterpenoid are intensely present in this plant [29,30]. Earlier studies revealed the presence of various phytochemicals in different solvent root extracts and also evidenced by the GC-MS analysis revealed the presence of about 100 bioactive compounds (Sitosterol, 9-Octadecenoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester, Dibutyl phthalate, Cyclopentasiloxane, 6-Octadecenoic acid, Heptadecane and Cyclohexasiloxane, dodecamethyl) [31]. The β -sitosterol is detected in *Diospyros montana* (leaves, stem bark, roots and seeds). It is an important plant sterol present in Diospyros which is reported to possess anticancer and adaptogenic properties. The estimated values are 651.99, 467.06, 447.14 and 323.87 $\mu\text{g mL}^{-1}$ for leaves, stem bark, roots and seeds respectively. Particularly richest source of β -sitosterol occur in *Diospyros montana* leaves [32].

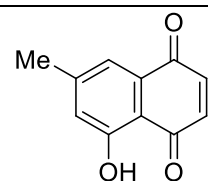
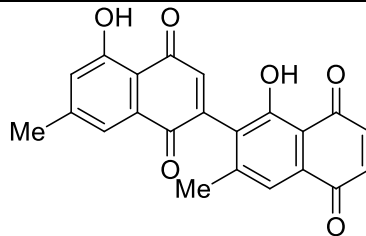
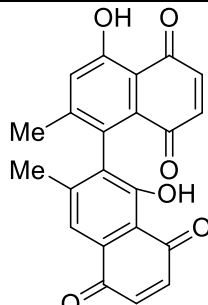
7 Antioxidant properties

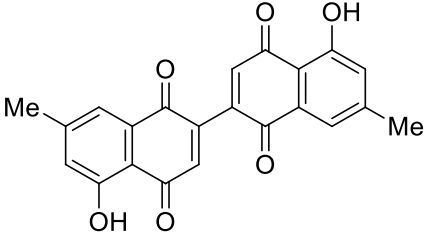
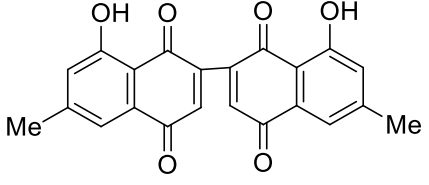
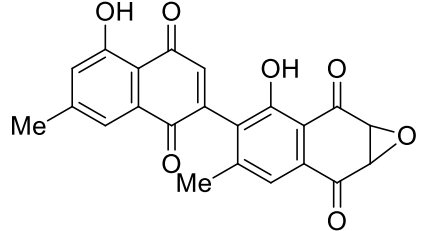
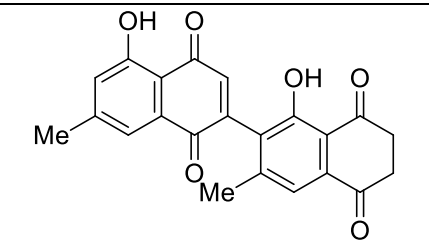
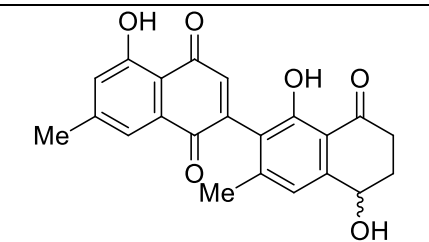
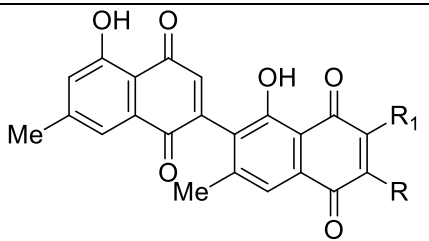
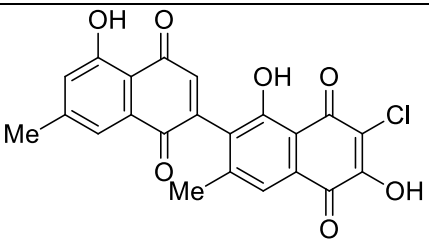
The different antioxidant mechanisms of *Diospyros montana* Roxb extract may be recognized to its strong abilities as a scavenger of superoxide radical and other free radicals. These results exposed that the leaves possess potent antioxidant activity presumably due to its substantial amount of polyphenolic and flavonoids content of the extracts [18].

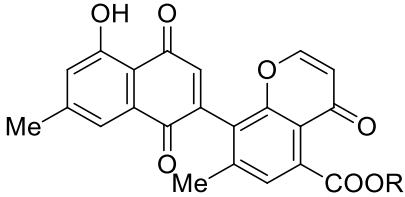
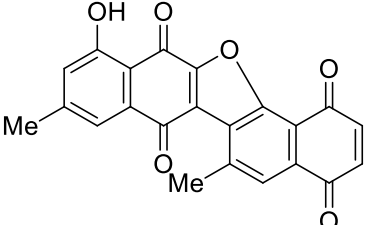
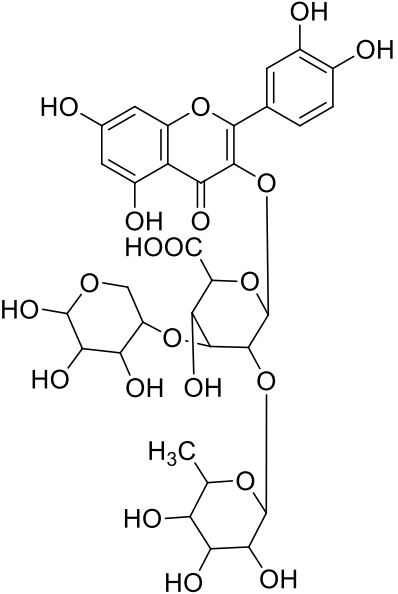
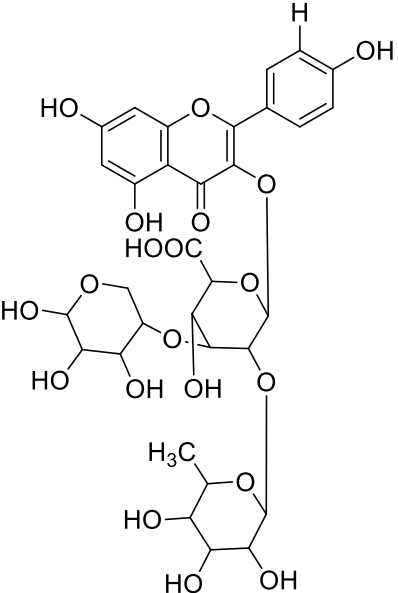
8 Isolation of biological compounds from various parts of *Diospyros montana* Roxb

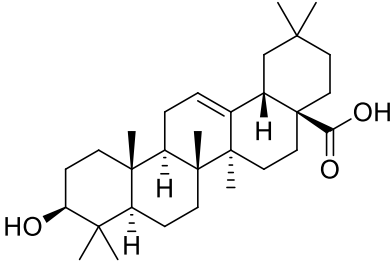
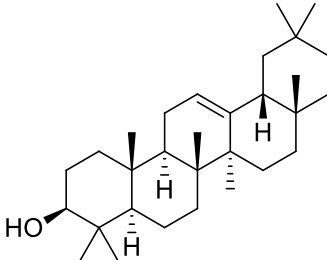
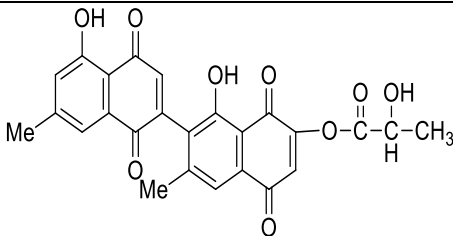
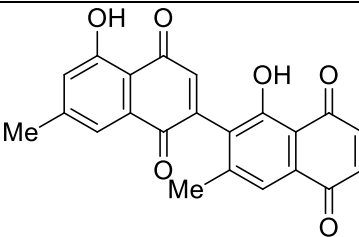
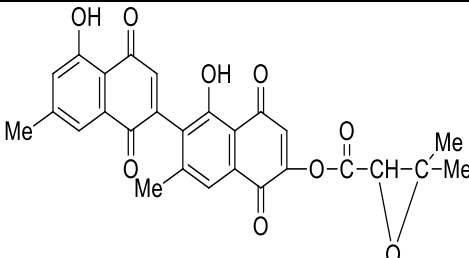
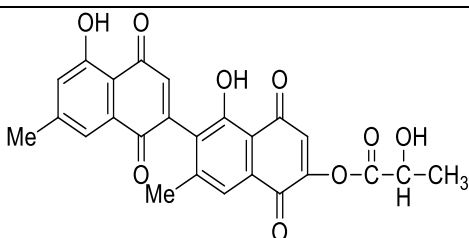
There are two Pentacyclic triterpenes like as β -amyrin and oleanolic acid are isolated from the leaves of *Diospyros montana* [33]. Diospyrin derivative such as Diospyrin, 3'-methoxydiospyrin, diospyrin-2'-(epoxy-3-methyl-butanoate), diospyrin-2'-(2-hydroxypropanoate), diospyrin-3'-(2-hydroxypropanoate) and tetrahydrodiospyrin are isolated from heartwood and bark of *Diospyros montana* [22]. Five flavonol glycosides (quercetin 3-O-2"- α -rhamnopyranosyl-3"- α - arabinopyranosyl- β -glucuronopyranoside, kaempferol 3-O-2"- α -rhamnopyranosyl-3"- α - arabinopyranosyl- β -glucuronopyranoside, quercetin 3-O- β -glucuronopyranoside, quercetin 3-O- β -rutinoside (rutin) kaempferol 3-O- β -rutinoside and quercetin) and two naphthalene dimer glycosides (diospyrol 8,8'-di-O-6- β -apiofuranosyl- β -glucopyranoside, diospyrol 8-O-(6- β -apiofuranosyl- β -glucopyranosyl)-8'-O- β -glucopyranoside), were isolated from the leaves of *Diospyros montana* [19]. Chemical constituents like α -amyrin, β -sitosterol, ursolic acid are isolated from fruit pulp [34], diospyrin from stem bark and lupeol, iododiospyrin from wood of *Diospyros montana* [35]. Some other numerous isolated biological molecules listed in the Table 1. Hence an effort was made to carry out wide phytochemicals studies, chromatographic assessment and isolation of metabolites from the various parts of *Diospyros montana* plant.

Table 1: Isolated compounds from *Diospyros montana* Roxb in various parts

| S. No | <i>Diospyros montana</i> parts | Isolated Compounds | Structure | Reference |
|-------|--------------------------------|--------------------|--|-----------|
| 1 | Bark | 7-Methyljuglone |  | [36] |
| 2 | Leaves, Stem bark and Wood | Diospyrin |  | [36] |
| 3 | Bark | Isodiospyrin |  | [36] |

| | | | | |
|----|------------|--|--|------|
| 4 | Bark | Biramentacenone |  | [36] |
| 5 | Bark | Mamegakinone |  | [36] |
| 6 | Bark | Diosquinone |  | [36] |
| 7 | Fresh bark | β -Dihydrodiospyrin |  | [37] |
| 8 | Fresh bark | Tetrahydrodiospyrin |  | [38] |
| 9 | Wood | 2'- Chlorodiospyrin (R=Cl, R1=H) 3'- Chlorodiospyrin (R=H, R1=Cl) |  | [36] |
| 10 | Bark | 3'-Chloro-2'-hydroxydiospyrin |  | [36] |

| | | | | |
|----|--------|--|--|---------|
| 11 | Bark | 8-(5-Hydroxy-7-methyl-1,4-naphthoquinon-2-yl)-7-methyl-4-oxochromen-5-carboxylic acid Red crystals (R=H) and its ethyl ester (R=Et) |  | [39,40] |
| 12 | Wood | 3,5'-O-Cyclodiospyrin |  | [36] |
| 13 | Leaves | Quercetin 3-O-2''-α-rhamnopyranosyl-3''-α-arabinopyranosyl-β-glucuronopyranoside |  | [19] |
| 14 | Leaves | kaempferol 3-O-2''-α-rhamnopyranosyl-3''-α-arabinopyranosyl-β-glucuronopyranoside |  | [19] |

| | | | | |
|----|--------------------|---|--|------|
| 15 | Leaves | Oleanolic acid |  | [33] |
| 16 | Leaves | β -amyrin |  | [33] |
| 17 | Heartwood and Bark | diospyrin-3'-(2-hydroxypropanoate) |  | [22] |
| 18 | Heartwood and Bark | Diospyrin |  | [22] |
| 19 | Heartwood and Bark | diospyrin-2'-(epoxy-3-methyl-butanoate) |  | [2] |
| 20 | Heartwood and Bark | diospyrin-2'-(2-hydroxypropanoate) |  | [22] |

9 Discussion

The various parts of *Diospyros montana* Roxb have been used in the treatment of fever, dysentery, pneumonia, hiccups, urinary stones, liver disorders, dysuria, gravel, puerperal fever, neuralgia and spider bite poison [22]. The plant leaves and seeds extracts exhibited antibacterial activity. The bark extract used as anti-inflammatory, antipyretic and analgesic agent and alcoholic bark extract inhibited Ehrlich ascites carcinoma in mice [41]. In addition, bark is recommended to use against jaundice and gum recommended for use in tuberculosis. Its tender twigs and leaves are used as fodder [42] and crushed leaves also used to

poison fish [43]. Its bitter are fruits with an unpleasant odour. They are venomous and applied on the surface to boils [44]. Its wood is classified as a good fuel, moderately hard and is used for making small furniture [22]. Indian traditional system of medicine mentioned the bark of *Diospyros montana* is used to prevent delirium in high fever, fruits for cracks in sole of feet and roots as abortifacient [45]. Rakesh Kumar *et al.*, (2009) [46] screened the potential anti-filarial activity of fruit of *Diospyros montana* was found to possess potential anti-filarial activity. *Diospyros montana* heart wood methanolic extract exhibit significant antioxidant activity. Twenty useful biological compounds were isolated from various parts of the plant.

10 Conclusion

This review show that *Diospyros montana* possess many biological activities but in concern to its traditional uses researchers can still evaluate various pharmacological properties of this significant medicinal plant. Phytochemical study of *Diospyros montana* indicated the presence of primary and secondary metabolites in the plant. Multiple advantageous phytochemicals like α -amyrin, β -sitosterol, ursolic acid, diospyrin, lupeol, iododiospyrin, oleanolic acid and β -amyrin, Diospyrin derivative, flavonol glycosides, quercetin and kaempferol are isolated from the plant various parts. It is evident from the review that the *Diospyros montana* possess enormous potent bio constituents with abundant pharmacological properties. This concludes that the plant shall serve as a significant source of potential drug and shall be useful for researchers to evaluate its efficacy against various diseases studied by both *in vitro* and *in vivo* methods which shall be benefit to the health care of human -kind.

11 Declarations

11.1 Acknowledgements

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11.2 Competing Interests

The authors declare there is no conflict of interest.

11.3 Publisher's Note

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References

- [1] Ullah R, Alqahtani AS, Noman OMA, Alqahtani AM, Ibenmoussa S, Bourhia M, A review on ethno-medicinal plants used in traditional medicine in the Kingdom of Saudi Arabia, *Saudi JBiologi Sci* 2020; 2706-2718.
- [2] Shailesh S, Sahu KR, Dewagan S, Yogita S, Sanjeev K. Medicinal value of (*Morus alba*) mulberry plant. *Inter Res J* 2009; 2(5): 449-450.
- [3] Singh R. Medicinal plants: A review. Special issue: medicinal plants. *J Plant Sci* 2015; 3(1): 50-55.
- [4] Prajapati ND, Purohit SS, Sharma AK, Kumar T. A hand book of medicinal plants. Jodhpur: Agrobios (2003).
- [5] Rao MR, Palada MC, Becker BN. Medicinal and aromatic plants in *Agroforestry systems* 2004; 61(1-3): 107-122.
- [6] Ahmad S, Zahiruddin S, Parveen B, Basist P, Parveen A, Gaurav, Parveen R and Ahmad M Indian Medicinal Plants and Formulations and Their Potential Against COVID19–Preclinical and Clinical Research. *Front Pharmacol* 2021; 11:578970.
- [7] Oluwakayode O, Christiana EO, Elias EE, Grace O. Phytochemical screening, antioxidant and antimicrobial activities of *Acalypha ciliata* plant. *ClinPhytosci*2016; 2:12.
- [8] Lin ASR, Sundar Rao K, Sang CJ, Narsimha R, Paul T, Smith John B, Kirubakaran S, Gerald M, Ming Jie W. Antioxidant and anti-inflammatory activities of selected medicinal plants containing phenolic and flavonoid compounds. *J Agri& Food Chem*2011; 59: 12361-12367.
- [9] Surendra Kumar S and Ajay PS. *In vitro* antioxidant and free radical scavenging activity of *Nardostachysjatamansi* Dc. *J Acupunct & Meridi Studi* 2012; 5(3): 112-118.
- [10] Khadka D, Dhamala MK, Li F, et al. The use of medicinal plants to prevent COVID-19 in Nepal. *J Ethnobiology Ethnomedicine* 2021;17: 26.
- [11] Ahmad Dar R, Shahnawaz M, Hassan Qazi P. General overview of medicinal plants: A review. *J. Phytopharmacol*2017; 6(6): 349-351.

- [12] Owoabi J, Omogbai EKI, Obasuyi O. Antifungal and antibacterial activities of the ethanolic and aqueous extract of *Kigella africana* (Bignoniaceae) stem bark, *Afr. J. Biotechnol* 2007; 6(14): 882-885.
- [13] WHO, WHO Traditional Medicine strategy 2002-2005, World Health Organization.
- [14] Vinoth S, Rajesh Kanna P, Gurusaravanan P, Jayabalan N. Evaluation of phytochemical, antimicrobial and GC-MS analysis of extracts of *Indigoferatrita* L.F. *Subulata* (Vahl ex poir), *Int J Agric Res* 2011; 6(4): 358-367.
- [15] Abhijeet Vishnu Puri. Isolation and characterization of triterpenes from *Diospyros montana* (Roxb.) leaves. *J Pharmacogn Phytochem* 2020;9(3):113-118.
- [16] Salih AOA, Ali mahmoud MM. Chemical and physical properties and gas chromatography mass spectrometer analysis of *Ocimum Basilicum* oil. *Int J Adv Res* 2015; 3(8): 818-826.
- [17] Prakasha HM, Krishnappa M, Krishnamurthy YL, Poornima SV. Folk medicine of NR Pura Taluk in Chikamagalur district of Karnataka, *Indian J Trad Knowl* 2010; 9(1): 55-60.
- [18] Puri AV. Quantitative phytochemical screening, thin-layer chromatography analysis, high-performance thin-layer chromatography fingerprinting, and antioxidant activity of leaves of *Diospyros Montana* (Roxb.), *Asian J Pharm Clin Res* 2019; 12(2):325-331.
- [19] Tanakaa T, Furusawa M, Ito T, Iliya I, Oyama M, Iinuma M, Tanaka N and Murat J. Phenolic Constituents of Leaves of *Diospyros montana*, *Natural Product Communication*. 2007; 2 (1).
- [20] Puri AV. Phytochemical investigations and evaluation of *Diospyros Montana* leaves for antioxidant activity, 2010.
- [21] Maridass M, Ghanthikumar S, Raju G. Phytochemical analysis of *Diospyros* species. *Ethnobotanical Leaflets* 2008; 12: 868-72.
- [22] Sharma V. *Diospyros montana* Roxb. A source of 1, 4-naphthoquinone dimers counting diospyrin esters, (*IOSR-JAC*) 2017; 10(1): 25-26.
- [23] Kranti Rai and Ela Tiwari. A Poisonous Forest Tree “Vishtendu” (*Diospyros Montana* Roxb.): Taxonomic Evaluation. *IJSR-International Journal scientific Research*, 2014; 3(10): 2277 -8179.
- [24] Ebbo AA, Mammam M, Suleiman MM, Ahmed, A. A: Preliminary phytochemical screening of *Diospyros mespiliformis*. *Anat Physiol* 2014; 2161.
- [25] Kantamreddi VS, Wright CW. Investigation of Indian *Diospyros* species for antiplasmodial properties. *Evid. Based Complement. Altern. Med* 2008; 5: 187–190.
- [26] Kokila K, Elavarasan N, Sujatha V. *Diospyros montana* leaf extract-mediated synthesis of selenium nanoparticles and their biological applications. *New J Chem* 2017; 41: 7481–7490.
- [27] Sarma MD, Ghosh R, Patra A, Hazra B. Synthesis and antiproliferative activity of some novel derivatives of diospyrin, a plant-derived naphthoquinonoid. *Bioorganic Med. Chem.* 2007; 15: 3672–3677.
- [28] Hazra B, Pal S, Banerjeet A, Ray R, Bhattacharya DK. Pharmacological studies on the effect of the treatment of Swiss mice with diospyrin, atumor-inhibitory plant product, and its synthetic derivatives. *Phytother Res* 1996; 10: 393-7.
- [29] Puri AV. Microscopical evaluation, phytochemical screening, and high-performance thin-layer chromatography fingerprinting of leaves of *Diospyros montana* (Roxb.). *Inter. J Green Pharm* 2018; 12(3): 205.
- [30] Devaraj Bharathi M, Diviya Josebin, · Seerangaraj Vasantharaj, Bhuvaneshwari V. Biosynthesis of silver nanoparticles using stem bark extracts of *Diospyros montana* and their antioxidant and antibacterial activities. *J Nanostr Chem* 2018; <https://doi.org/10.1007/s40097-018-0256-7> 2018.
- [31] Bodele SK, Shahare NH. Phytochemical Screening and GC-MS Analysis of *Diospyros montana* (Roxb.) root, *Int. J. Res. in Pharmacology & Pharmacotherapeutics* 2018;7(2): 100-107.
- [32] Shravan Kumar, Sakshi Sehgal, Hafsa Ahmad, Rajiv Gupta, Shubhini A. Saraf. Pharmacognostic and HPTLC studies on *Diospyros montana* R. (Ebenaceae) *Pharmacognosy Journal* 2011; 3(25): 52-62.
- [33] Puri AV. Isolation and characterization of triterpenes from *Diospyros montana* (Roxb.) leaves, *Journal of Pharmacognosy and Phytochemistry* 2020; 9(3): 113-118.
- [34] Misra G, Nigam SK and Mitra CR. Reported steroids and triterpenoids of *Iospyros montana*. 1972.
- [35] Musgrave OC, Skoyles D. *Journal of the Chemical Society Perkin Transactions*, I: 1974; 1128.
- [36] Lillie, T. J., Musgrave, O. C., Skoyles, D. ‘Ebenaceae extractives. Part V. New diospyrin derivatives from *Diospyros montana* Roxb’, *Journal of the Chemical Society, Perkin Transactions* 1, 1976; (20):2155-2161.
- [37] Pardhasaradhi, M., Sidhu, G. S. ‘β’- Dihydrodiospyrin-the first reduced bisnaphthaquinone’, *Tetrahedron Letters* 1972; 13(41):4201-4204.
- [38] Pardhasaradhi, M., & Krishnakumari, L. ‘Tetrahydrodiospyrin: a reduced binaphthoquinone from the bark of *Diospyros montana*’, *Phytochemistry*, 1979; 18(4):684-685.
- [39] Jeffreys, J. A. D., Bin Zakaria, M., Waterman, P. G., & Zhong, S. ‘A new class of natural product: Homologues of juglone bearing 4-hydroxy-5-methyl-coumarin-3-yl units from *Diospyros* species’, *Tetrahedron Letters* 1983; 24(10):1085-1088.
- [40] Ebert, G., Gross, J. ‘Carotenoid changes in the peel of ripening persimmon (*Diospyros kaki*) cv Triumph’, *Phytochemistry* 1985; 24(1):29-32.
- [41] Asolkar LV, Kakkar KK, Chakre OJ. Second supplement to glossary of Indian Medicinal plants with active principles, 1965; CSIR, New Delhi, Part-1:279.
- [42] Santapau R. *History of botanical researches in India, Burma and Ceylon*. 1958; Bangalore Press; Bangalore.
- [43] Kirtikar KR, Basu BD. *Indian Medicinal Plants*, II: 1975; 1506.
- [44] Jain SK, Defilippis RA. *Medicinal Plants of India*,; 1991;1: 286.
- [45] Mallavadhani UV, Panda AK, Rao YR. Pharmacology and chemotaxonomy of *Diospyros*. *Phytochemistry* 1998; 49: 901-51.
- [46] Rakesh Kumar, MehtabParveen, Anil Kumar, Waseem Rizvi. Screening of fruit of *Diospyros montana* for anti-filarial activity, *Journal of Natural Remedies* 2009; 9(1): 56-61.