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Brief Review on the Genus *Diospyros:* A Rich Source of Naphthoquinones

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ABSTRACT: *Diospyros* genus (Ebenaceae) comprises about 500 species. A number of them are used for their multiple pharmacological activities. Ethano-phramacologically various plant parts are formulated and prescribed in the form of extracts and the decoctions for remedy of different diseases in many tribes. These activities are due to presence of bioactive secondary metabolites in the plant. Systematic and detailed investigation on the composition and pharmacological significance of medicinal plants should be conducted to standardize the formulations, based on ingredients. In the present review, naphthoquinone, naphthalene and naphthol derivatives isolated from *Diospyros* species are documented here with the pharmacologically important species of the genus.

Keywords: *Diospyros* genus; species; Ebenaceae; pharmacological activities; naphthoquinones.

INTRODUCTION: *Diospyros* genus belongs to the family Ebenaceae. The plants of Ebenaceae are wide spread in tropics and sub tropics, occasionally into temperate areas. According to Hegnaeur[1] the family consists of seven genera, namely *Diospyros, Euclea, Maba, Oncothea, Rhaphidanthe, Royena* and *Tetraclis.* However at present *Maba, Rhaphidanthe, Royena* and *Tetraclis* are included under *Diospyros* and *Oncotheca* is included as a monotypic family[2]. Thus most of the botanists consider that it is composed of the three genera *Diospyros, Euclea and Lassiocarpa.* The genus *Diospyros* Linn. is by far the largest with 500 species[3] out of which 50 species are found in India[4], mostly in the evergreen forests of Deccan, Assam and Bengal. A few of them occur in N. India also[5].

Medicinal impotence of the *Diospyros* Species: Chemical examination of Ebenaceae generally confined to the genus *Diospyros.* A number of *Diospyros* species are reputed for their local herbal medicinal uses[6,7]. In the treatment of asthma, abdominal pains, dysentry, leprosy, whopping cough, menstrual troubles and as antibiotics several parts of the plant have been used since a long time. 50% Ethanol extract of *D. montana* and *D.pereqrina* were found to have weak antiprotozoal[8], antiviral and hypoglycemic activity. The common persimmones are the edible fruits of *D.kaki* and *D.discolar*. Naphthoquinones and other related quinonoid compounds are one of the major natural product classes with varied biological activities[9-11]. The medicinal properties of some of the *Diospyros* species are as follow; A decoction of *D.candolleana* bark is used in rheumatism and swellings[12]. Barks of *D.exsculpta* and *D.malabarica* are used as a remedy for dysentry[5]. The bark extract of *D.ferrea* Bakh, Willd syn. *Mababuxifolia* is found to have antitumour activity[13]. Leaves of *D.malanoxylon* are diuretic, laxative and stypic. Its dried flowers are reported to be used in urinary, skin and blood diseases. A dilute extract is used as an astringent lotion for eyes[5]. Heartwood of *D.mollis* has been found to be active against hookworms but less active against tapeworms[14].

Stem of *D.maritima* Blume is used to treat rheumatic diseases in Taiwan[15]. *D.morrisiana* bark has been shown to exhibit antibiotic activity[16], known as "Shan Hung Shih" in herbal medicine of Taiwan. Bark of *D.nigra* is antirheumatic[17] and is also used in swellings, the fruits are antidysentric and the leaves are laxative, styptic and antileucorrhoeic[18]. Bark of *D.peregrina* Gurke is used in the treatment of dysentry and intermittent fevers[19]. Its ethanolic extract has been claimed to possess anti protozoal activity against *Entamoeba histolitica*, antiviral activity against Ranikhet disease virus and hypoglycemic activity in albino rats[8]. Leaves of *D.quaesita* Thw are used for treatment of asthma[20]. In bark extract of *D.tomentosa* hyposensitive activity was confirmed[21]. *D. tricolor* is reported to be efficaciuos in leprosy.

A purified extract of persimmon fruits has been shown to exhibit a strong detoxifying activity on various snake venom but not against bee venom[22]. The antibacterial, antifungal and antiallergic properties of *Diospyros* have been attributed to the presence of naphthoquinones[23]. The most interesting is their biological activity against parasitic protozoa namely *Leishmania, Trypnosoma and Plasmodium.* Plumbagin and other related quinones have been active against *Leishmania* spp., while diospyrin was found to be active against *Leishmania donovani*[24].

The heartwood of this genus has considerable economic importance as a source of timbers and also as edible fruits[25,26]. The heartwood of *D.ebenum* (ebony tree) is

extremely hard, durable and resistant to seasonal changes[5]. *D.quaesita* is well known for the quality of timber known as calamander or king Ebony. Furniture made from its timber is so highly ranked that this tree was exploited to near extinction during the Dutch occupation of Sri Lanka[20]. In a brief study carried on the resistance of various timbers of *Diospyros* species, the allelochemicals, such as quinones, flavonoids, and terpenoids possess natural repellant and toxic properties[27].

The wood of *D.celebica* was found to be highly resistant to the subterranean termites, *Reticuliterms lusi-fungus* and *Reticuliterms flaviceps*[28]. The napthoquinones isodiospyrin, microphyllone and plumbagin were identified as major termicidal components, while diospyrin, a major naphthoquinone of *D.montana* was not toxic to termites at the concentration tested. 7-Methyljuglone showed to be toxic at 0.100 g in 24 h while the dimer less toxic to termites[29].

D.montana Roxb. (Commonly known as bistendu) is a shrub of moderate size, which is distributed throughout the greater part of India. Different parts of this plant have been reported to be used in the treatment of dysentry, hiccups, urinary stones and liver disorders[30]. Its leaves and seeds extract exhibited antibacterial activity[31]. Its various parts have been reported to be efficacious in fever, dysuria, gravel, neuralgia, pneumonia, puerperal fever and spider bite poison[32]. Its bark extract has been reported to be used as anti inflammatory, antipyretic and analgesic. Alcoholic extract of its bark inhibited Ehrlich ascites carcinoma in mice[32]. Its tender twigs and leaves are used as fodder[33]. Its crushed leaves are used by *Mundas* of Chhota Nagpur to poison fish[34]. *Meliola diospyri* syd. an ascomycetes fungi, is reported on the leaves of this plant. Its fruits are bitter with an unpleasant odour. They are poisonous and applied externally to boils[35]. Its wood is moderately hard and is used for making small articles of furniture. It is classified as a good fuel wood.

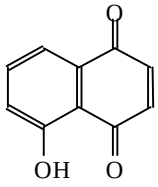
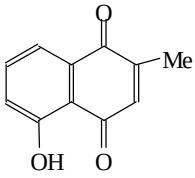
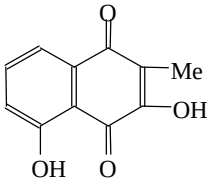
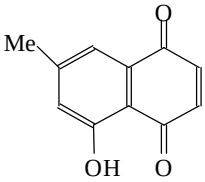
Phytochemical investigation on various parts (*viz*., bark, heartwood of stem and root, mesocarp) of over forty species of *Diospyros* have been revealed that these species are rich in naphthoquinones (table-1), naphthols. Flavonoid, triterpenoid and steroid derivatives are also occur in high yields. Triterpenes of the lupane series *viz*. lupeol, betulin and betulinic acid in addition to widely distributed β- sitosterol have proved to be good taxonomic markers of this genus[20]. This genus is however, characterized by the ability to produce naphthoquinones, usually in the form of dimers and triterpenes of the lupane series.

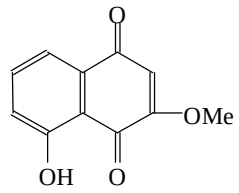
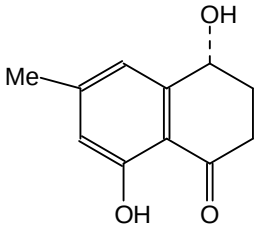
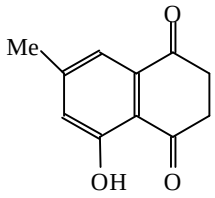
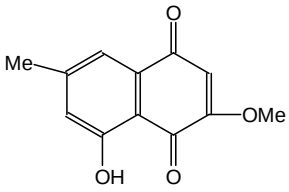
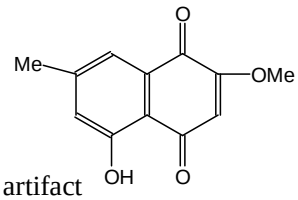
The *Diospyros* species are rich source of naphthols , dimers of 7-methyljuglone (5-hydroxy-7-methyl-1 , 4-naphthoquinone) and plumbagin (5-hydroxy- 2-methyl-1, 4-naphthoquinones). Diospyrol isolated from fresh berries of *D. mollis* is the only example of dimeric naphthol. Naphthols being sensitive to oxidation are easily converted to black polymeric material. These compounds are supposed to be derived from the oxidative coupling of 3-methyl - naphthalene-1,8-diol or their biogenetic equivalents arising by the hydroxylations at the 2,4,5 or 7-positions .

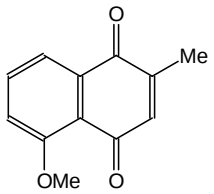
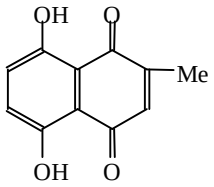
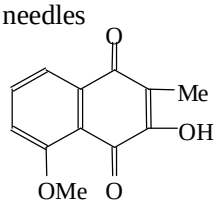
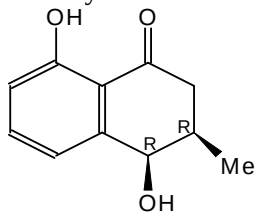
Dimerisation may also take place at 2,4,5 or 7-positions[22]. Isodiospyrin, diospyrin and mamagakinone examplify the three ways in which the two naphthoquionones units link together, namely arene to arene, arene to quinone and quinone to quinone respectively[36]. On the basis of structural features, it has been suggested that naphthol and naphthoquinone derivatives of *Diospyros* species are formed from acetate -polymelonate units. Four pathways have been described for the biosynthesis of naphthoquiones in higher plants[37,38].

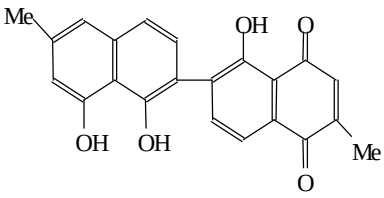
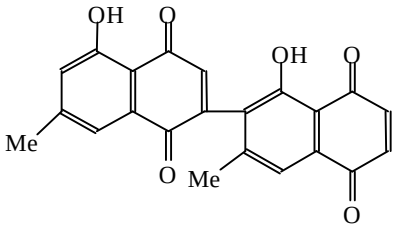
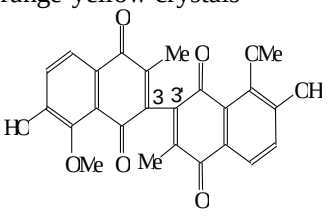
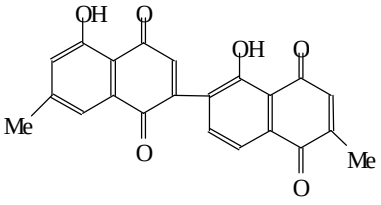
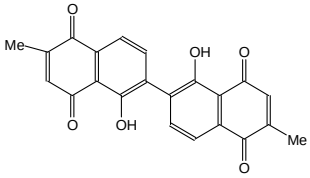
Figure 1: Some examples of *Diospyros* species.

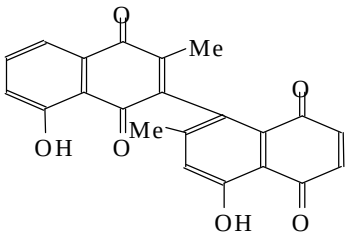
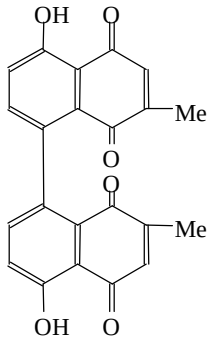
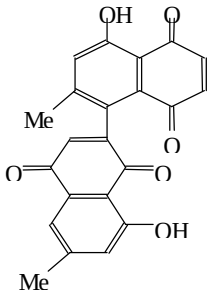
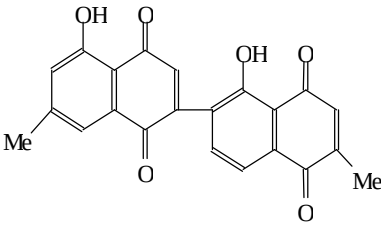
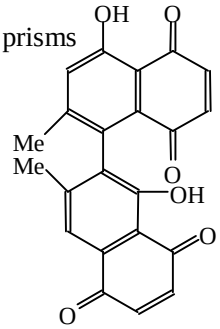
Table-1 contains a list of naphthalene, naphthol and naphthoquinone derivatives isolated from various *Diospyros* species. The naphthoquinone isodiospyrin isolated from stem and roots of *D. morrisiana* showed cytotoxic activity in HCT-8 and P-388 screens[77]. A major quinone diospyrin isolated from bark of *D. montana* exhibited growth inhibitory activity towards *Ehrlich ascites* carcinoma in mice[13].

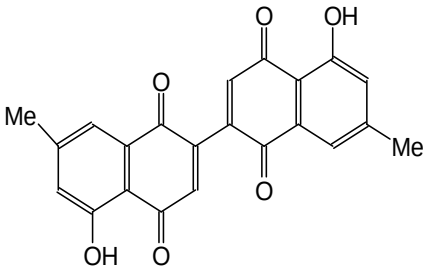
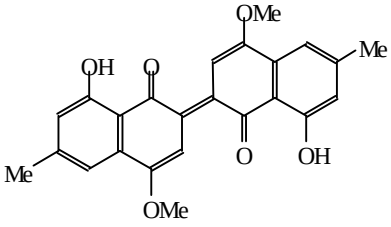
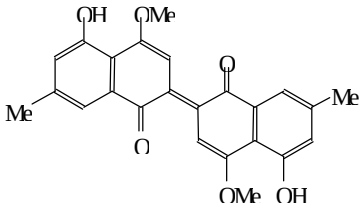
S. No.	Compound	Molecular formula & Melting point	Source	Plant part[Ref.]
1.	Juglone Orange needles 	$C_{10}H_6O_3$ 164-65°	*D. lycioides*	*[39]
2.	Plumbagin(2-Methyljuglone) Orange needles 	$C_{11}H_8O_3$ 75°	*D. elliptifolia* *D. gracilipes* *D. hebecarpa* *D. hoyleana* *D. kaki* *D. maritima* *D. mespiliformis* *D. samoensis*	Bark[40] Root bark & Stem bark[41] Leaves & Bark[42] Roots & Bark[43] Roots[44] Bark[45], Roots[22] & Fresh fruits[46] Bark[47] Leaves[48]
3.	Droserone Yellow needles 	$C_{11}H_8O_4$ 181°	*D. maritima*	Fresh fruits[46]
4.	7-Methyljuglone Orange-red needles 	$C_{11}H_8O_3$ 124-25°	*D. abloflavescens* *D. chloroxylon* *D. ebenaster* *D. greenwayi* *D. hallierii* *D. lotus* *D. melanoxylon* *D. montana* *D. nicaraguensis* *D. squarrosa* *D. usambarensis*	Bark, Root & Leaves[43] Stem[44], Stem bark[44] & Wood[45] Roots[46] Root bark & Stem bark[47] Root bark, Stem bark & Fruit[48] Roots[49] Bark, Sapwood & Ebony[50] Bark[36] Wood[51] Root bark & Stem bark[52] Root bark[53]

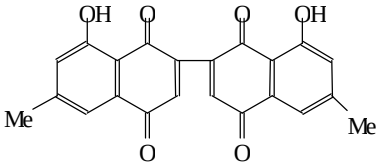
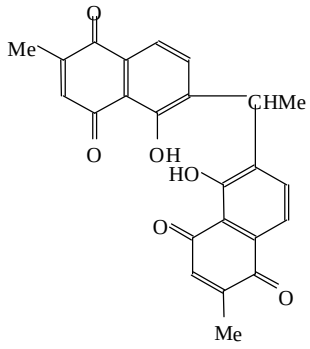
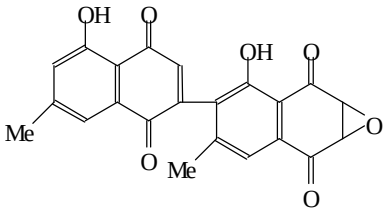
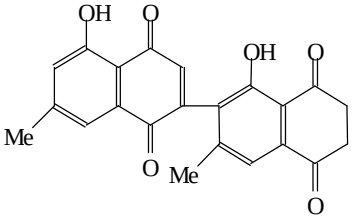
5.	3-Methoxyjuglone 	$C_{11}H_8O_4$	*D. morrisiana*	Heartwood[54]
6.	Shinanolone Colourless needles 	$C_{11}H_{12}O_3$ 108°	*D. japonica* *D. kaki* var. *sylvestris* *D. morrisiana*	Roots[55] Roots & Woods[44] Heartwood[54]
7.	7-Methyl-β-dihydrojuglone 	$C_{11}H_{10}O_3$ 112-13°	*D. hebecarpa*	Fresh leaves[56]
8.	3-Methoxy-7-methyljuglone*  *probably artifact	$C_{12}H_{10}O_4$ 209-10°	*D. usambarensis* *D. kaki*	Root bark[53] Roots[57]
9.	2-Methoxy-7-methyljuglone *  *probably artifact	$C_{12}H_{10}O_4$	*D. usambarensis*	Root bark[53]
10.	2,6-Dimethoxy-7-methoxycarbonyljuglone Orange crystals	$C_{14}H_{12}O_7$ 194°	*D. montana*	Stem[44]

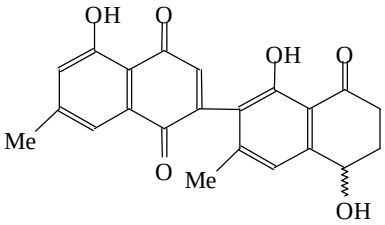
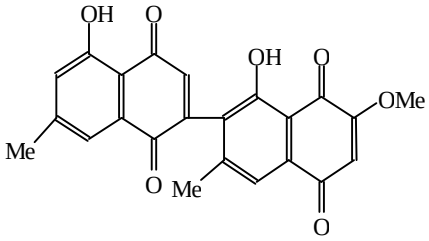
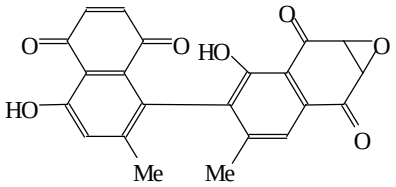
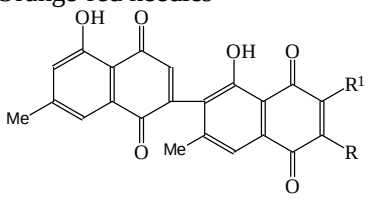
11.	Plumbagin methyl ether Yellow needles 	$C_{12}H_{10}O_3$ 94°	*D. melanoxylon*	Heartwood [125]
12.	2-Methylnaphthazarin Bronze-green plates 	$C_{11}H_8O_4$ 174-75°	*D. heterotricha* *D. lycioides* spp. *sericea*	Root bark[58, 59] Root bark[59]
13.	Droserone-5-methyl ether Yellow needles 	$C_{12}H_{10}O_4$ 173-74°	*D. melanoxylon*	Heartwood[47]
14.	Yerrinquinone Orange clusters	$C_{14}H_{12}O_7$ 193°	*D. montana*	Fungal infected stem[60]
15.	Isoshinanolone Colourless crystals 	$C_{11}H_{12}O_3$ 160° (d)	*D. maritima* *D. samoensis* *D. siamang*	Roots[22] Leaves[48] Stem bark & Wood[61]
16.	3-Bromoplumbagin (R=Br) 3-Chloroplumbagin (R=Cl) Orange-yellow leaflets	$C_{11}H_7BrO_3$ $C_{11}H_7ClO_3$ 125°	*D. maritima*	Fresh fruits[48]
17.	8-Methoxy-3-methyl-1,2-naphthoquinone Red crystals	$C_{12}H_{10}O_3$ 144°	*D. melanoxylon*	Heartwood[47]
18.	Diomelquinone A Orange needles	$C_{12}H_{10}O_4$ 152-53°	*D. melanoxylon*	Heartwood[62]
19.	Canaliculatin Yellow plates	$C_{21}H_{14}O_6$ >300°	*D. canaliculata*	Stem bark[63,64]

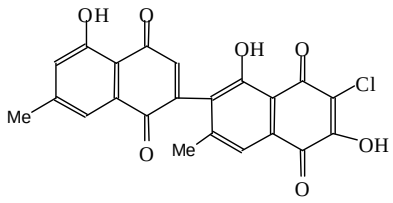
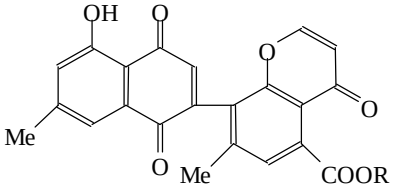
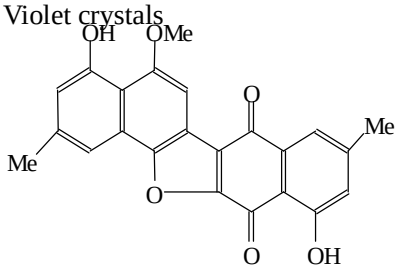
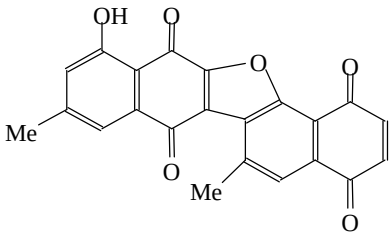
20.	Ebenone Brown crystals 	$C_{22}H_{16}O_5$ 231-32°	*D. ebenum*	Stem bark[65]
21.	Diospyrin Orange-red cubes/prisms 	$C_{22}H_{14}O_6$ 258°	*D. chloroxylon* *D. gilleti* *D. hoyleana* *D. kaki* *D. mespiliformis* *D. montana*[61] *D. piscatori*	Stem, Stem Bark[44], Wood[45] & Dried roots[66] Roots & Barks[43] Roots[44] Roots & Barks[43] Roots[44] Bark[40], Leaves[67], Stem bark[68] &Wood[36] Roots[69]
22.	3,3'- Bidiomelquinone A Orange-yellow crystals 	$C_{24}H_{18}O_8$ 292-94°	*D. melanoxylon*	Wood[70]
23.	Ehretione Orange needles 	$C_{22}H_{14}O_6$ 232° (d)	*D. ehretioides*	Wood[71]
24.	Elliptinone Orange needles 	$C_{22}H_{14}O_6$ > 310°	*D. ebenum* *D. elliptifolia* *D. maritima* *D. mollis* *D.samoensis*	Stem bark[65] Bark[40] Fresh fruits[72] & Roots[22] Dried fruits, Bark & Fresh-roots[73] Leaves[48]

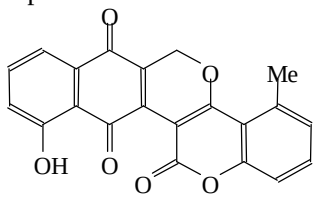
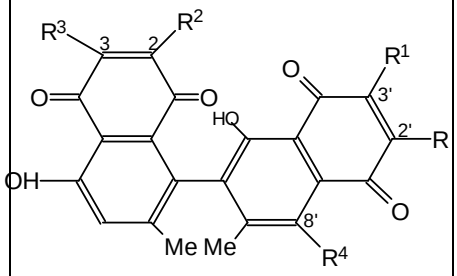
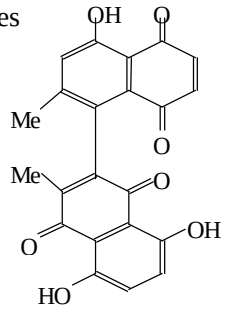
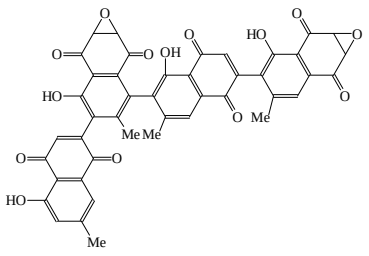
25.	Habibone Deep red mass 	$C_{22}H_{14}O_6$ 260-61°	*D. greenwayi*	Root bark[47]
26.	Maritinone Red needles 	$C_{22}H_{14}O_6$ 193-95°	*D. kaki* *D. maritima* *D. samoensis*	Roots[57] Roots[22] & Fresh fruit[72] Leaves[48]
27.	Neodiospyrin Red needles 	$C_{22}H_{14}O_6$ 205-10°(d)	*D. ismailii* *D. kaki* *D. rotundifolia*	Wood & Fruit[61] Roots[57,62] Roots[74]
28.	Rotundiquinone Red needles 	$C_{22}H_{14}O_6$ 320° (d)	*D. batocana* *D. ismailli* *D. rotundifolia*	Root bark[75] Wood & Fruits[61] Roots[74,76]
29.	Isodiospyrin Orange-red prisms 	$C_{22}H_{14}O_6$ 226-28°	*D. bipindensis* *D. chloroxylon* *D. ebenaster* *D. ferrea* *D. gilleti* *D. japonica* *D. kaki* *D.morrisiana* *D. montana*	Stem bark[23] Stem, Wood & Stem bark[44,45] Roots & Bark[46] Roots[22] Roots & Bark[43] Roots[55] Roots[44] Stem[77], Heartwood[54,78,79]&

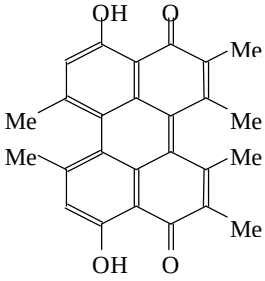
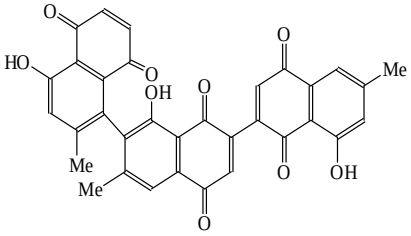
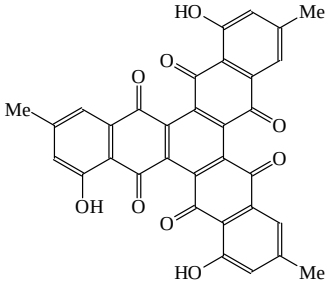
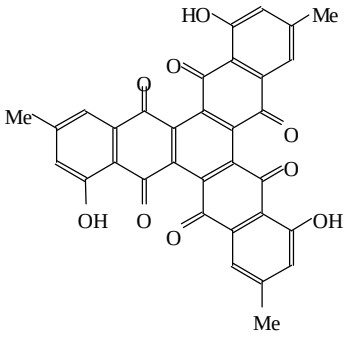
			D. texana *D. usambarensis* *D. virginiana* *D. zombensis*	Roots[80] Bark[36] Roots & Bark[46] Root bark[53] Bark & Wood[40] Root bark[81] Root bark[81]
30.	Biramentacenone Orange-yellow rods 	$C_{22}H_{14}O_6$ 235° (d)	*D. lolin*[77] *D. maritima*[77] *D. melanoxylon* *D. montana* *D. novoguiensis*[77]	Heartwood[82] Bark[36]
31.	Diosindigo A Blue needles 	$C_{24}H_{20}O_6$ 317° (d)	*D. bipindensis* *D. buxifolia* *D. cauliflora* *D. consolatae* *D. ehretioides* *D. greenwayi* *D. heterotricha* *D. mafiensis* *D. melanoxylon* *D. squarrosa*	Bark[23] Sapwood[84] Wood[85] Root & Stem bark[52] Wood[85] Root bark & Stem bark[47] Root bark[58] Stem bark[86] Heartwood[83] Root bark & Stem bark[52]
32.	Diosindigo B Blue needles 	$C_{24}H_{20}O_6$ 232-34°	*D. melanoxylon* *D. usambarensis*	Heartwood[83] Root bark & Stem bark[87]

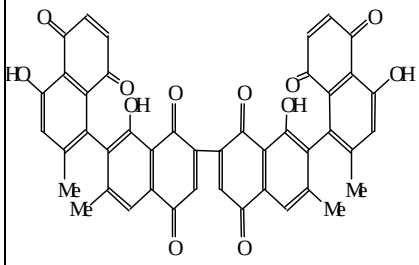
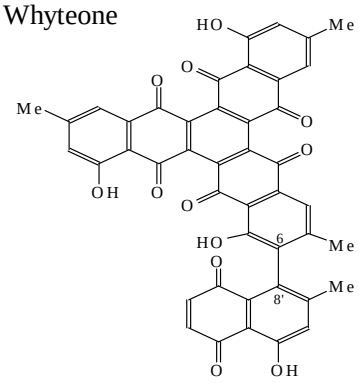
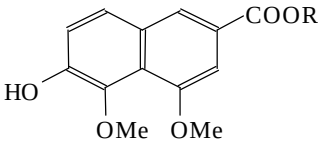
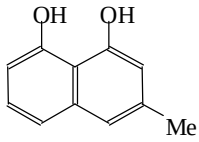
33.	Mamegakinone Orange crystals 	$C_{22}H_{14}O_6$ 253° (d)	*D. kaki* *D. lotus* *D. Lycioides* *D. mollis* *D. montana* *D. usambarensis* *D. zombensis*	Roots[44], Roots[49,80] Root bark[88] Dried fruits, Bark & Fresh Roots[73] Bark[36], Root bark[53], Root & Stem bark[87] Root bark & Stem bark[52]
34.	Ethylidene-6,6'-biplumbagin 	$C_{24}H_{18}O_6$	*D. maritima*	Fresh fruits[72]
35.	Diosquinone Orange-red needles 	$C_{22}H_{14}O_7$ 200-00.5°	*D. batocana* *D. mafiensis* *D.montana* *D. tricolor* *D. verrucosa*	Root bark[75] Root bark[85,86] Bark[36] Bark[89] Root bark & Stem bark[90]
36.	β-Dihydrodiospyrin Orange-red crystals 	$C_{22}H_{16}O_6$ 226° (d)	*D. batocana* *D. montana*	Root bark[75] Fresh bark[91]

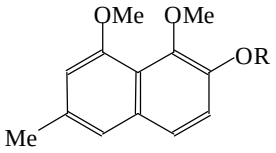
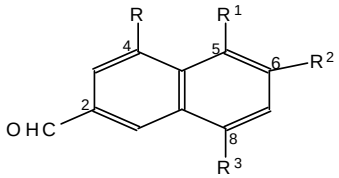
37.	Tetrahydrodiospyrin Red needles 	$C_{22}H_{18}O_6$ 198°	*D. montana*	Fresh bark[92]
38.	3'-Methoxydiospyrin Yellow-orange needles 	$C_{23}H_{16}O_7$ 220-25°	*D. mannii*	Stem bark[93]
39.	8'-Hydroxydiospyrin Red needles	$C_{22}H_{14}O_7$ 266-68°	*D. montana*	Bark[36]
40.	Batocanone 	$C_{22}H_{14}O_7$ 127-30°	*D. batocana*	Root bark[75,94]
41.	2'- Chlorodiospyrin (R=Cl, R^1=H) Red crystals 3'- Chlorodiospyrin (R=H, R^1=Cl) Orange-red needles 	$C_{22}H_{13}ClO_6$ 269-71° $C_{22}H_{13}ClO_6$ 266-68°	*D. montana*	Wood[36]

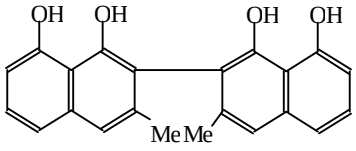
42.	3'-Chloro-2'-hydroxydiospyrin Red crystals 	$C_{22}H_{13}ClO_7$ 260-63°	*D. montana*	Bark[36]
43.	8-(5-Hydroxy-7-methyl-1,4-naphthoquinon-2-yl)-7-methyl-4-oxochromen-5-carboxylic acid Red crystals (R=H) and its ethyl ester (R=Et) Orange needles 	$C_{22}H_{14}O_7$ 262-64° $C_{24}H_{18}O_7$ 234-36°	*D. montana*	Bark[63,64]
44.	4,11-Dihydroxy-5-methoxy-2,9-dimethyldinaphtho[1,2-b:2',3'-d]furan-7,12-quinone Violet crystals 	$C_{23}H_{16}O_6$ 335-38°	*D. melanoxylon*	Heartwood[83]
45.	3,5'-*O*-Cyclodiospyrin Orange needles 	$C_{22}H_{12}O_6$ 269-71°	*D. montana*	Wood[36]

46.	Cyclocanaliculatin Yellow plates 	$C_{21}H_{12}O_6$ >300°	*D. canaliculata*	Bark[64]
47.	2'-Methoxyisodiospyrin (R=OMe, R^1=R^2=R^3=R^4=H) 3'-Methoxyisodiospyrin (R^1=OMe, R=R^2=R^3=R^4=H) 3,3'-Dimethoxyisodiospyrin (**(**R^1=R^3=OMe, R=R^2=R^4=H) 2,3'-Dimethoxyisodiospyrin (**(**R^1=R^2=OMe, R=R^3=R^4=H) 2,2'-Dimethoxyisodiospyrin (**(**R=R^2=OMe, R^1=R^3=R^4=H) 3,2'-Dimethoxyisodiospyrin (**(**R=R^3=OMe, R^1=R^2=R^4=H) 	$C_{23}H_{16}O_7$ $C_{23}H_{16}O_7$ $C_{24}H_{18}O_8$ $C_{24}H_{18}O_8$ $C_{24}H_{18}O_8$ $C_{24}H_{18}O_8$	*D. morrisiana*	Heartwood[54,79]
48.	8'-Hydroxyisodiospyrin Dark red needles 	$C_{22}H_{14}O_7$ 275-77°	*D. ferrea* var. *buxifolia* *D. lycioides* spp. *sericea*	Root bark[22] Root bark[88]
49.	6'',8'-Bisdiosquinone Deep brown crystals 	$C_{44}H_{26}O_{14}$ >315°	*D. mafiensis*	Root bark[86]

50.	4,9-Dihydroxy-1,2,6,7,11,12-hexamethylperylene-3,10-quinone Brown-red needles 	$C_{26}H_{22}O_4$	*D. natalensis*	Roots & Branches[76]
51.	Galpinone Orange-red needles 	$C_{33}H_{20}O_9$ >335°	*D. galpinni*	Roots & Bark[74,76]
52.	Isoxylospyrin Yellow crystals 	$C_{33}H_{18}O_9$ >350°	*D. galpinni* *D. hallierii* *D. whyteana*	Roots[74,76] Root bark & Stem bark[48] Roots & Branches[74,76]
53.	Xylospyrin Bright yellow crystals 	$C_{33}H_{18}O_9$ >400°	*D. chloroxylon* *D. ebenaster* *D. texana*	Wood[45] Bark[46] Bark[46]

54.	Bis-isodiospyrin Orange prisms 	$C_{44}H_{26}O_{12}$ >320°	*D. austroafricana* var. *rubriflora* *D. japonica* *D. lotus* *D. lycioides* *D. morrisiana* *D. piscatoria* *D. usambarensis*	Fruits[95] Roots[55] Roots[49,80] Fruits[95] Roots[80] Roots[69] Roots & Stem bark[87]
55.	6-{2-(7-Methyljuglone)}isodiospyrin		*D. chaemaethamnus*	Bark[96]
56.	Whyteone 	$C_{44}H_{24}O_{12}$	*D. galpinni* *D. whyteana*	Roots[76] Roots & Branches[74,76]
57.	6-Hydroxy-4,5-dimethoxy-2-naphthoic acid (R=H) Methyl-6-hydroxy-4,5-dimethoxy-2-naphthoate (R=Me) 	$C_{13}H_{12}O_5$ $C_{14}H_{14}O_5$	*D. ebenum*[95]	*[97]
58.	Naphthalene Derivative	$C_{15}H_{18}O_4$ 49°	*D. chloroxylon*	Stem & Stem bark[44]
59.	3-Methylnaphthalene-1,8-diol 	$C_{11}H_{10}O_2$	*D. mollis*	Berries[98]

60.	Macassar II (R=H) Colourless prisms Macassar III (R=CH_3) Pale yellow needles  	$C_{13}H_{14}O_3$ 107-07. 5° $C_{14}H_{16}O_3$ 70°	*D. celebica*	Heartwood[99]
61.	5-Hydroxy-4-methoxy-2-naphthaldehyde (R^1=OH, R=OMe, R^2=R^3=H) 4,5-Dimethoxy-2-naphthaldehyde (R=R^1=OMe, R^2=R^3=H) 6-Hydroxy-4,5-dimethoxy-2-naphthaldehyde (R^2=OH, R=R^1=OMe, R^3=H) Pale yellow needles 4,5,6-Trimethoxy-2-naphthaldehyde (R=R^1=R^2=OMe, R^3=H) Pale yellow plates 4,5,8-Trimethoxy-2-naphthaldehyde (R=R^1=R^3=OMe, R^2=H) 5-Hydroxy-4,6,8-trimethoxy-2-naphthaldehyde (R^1=OH, R=R^2=R^3=OMe) 4,5,6,8-Tetramethoxy-2-naphthaldehyde (R=R^1=R^2=R^3=OMe)  	$C_{12}H_{10}O_3$ $C_{13}H_{12}O_3$ $C_{13}H_{12}O_4$ 165° $C_{14}H_{14}O_4$ 125° $C_{14}H_{14}O_4$ $C_{14}H_{14}O_5$ $C_{15}H_{16}O_5$	*D. quiloensis* *D. ebenum* *D. ebenum* *D. mollis*	Heartwood[100] Heartwood[101] Heartwood[101] Dried fruits, Bark & Fresh fruits[73]

62.	Diospyrol 	$C_{22}H_{18}O_4$ 251-57°	*D. mollis*	Berries[98], Fruits[99], Dried ripe fruits[102] & Fresh fruits[73]

CONCLUSION: Phytochemical investigation on various plant parts (*viz*., bark, heartwood of stem and root, mesocarp) of over forty species of *Diospyros* have been revealed that these species are rich in naphthoquinones, naphthols. These phytochemicals have proved to be good taxonomic markers of this genus. This genus is however, characterized by the ability to produce naphthoquinones, usually in the form of dimers and triterpenes of the lupane series. Herein, we documented the different naphthoquinones present in the genus. Various *Diospyros* species have the potential multiple pharmacological and therapeutic activities which can be explained by the presence of various bioactive metabolites in the species. Different parts of the plants are employed as folk prescription and the related health products are unpersuasive, so conduction of detailed investigations on the composition and pharmacological significance of medicinal plants is an inevitable need to standardize the formulations, based on ingredients.

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