Ilam University of Medical Sciences

Plant Biotechnology Persa

Online ISSN: 2676-7414

Homepage: https://pbp.medilam.ac.ir

A Review on Exploring the Medicinal Potential of *Murraya koenigii*: Photochemistry, Pharmacology, and Therapeutic Benefits

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Article Info

Article type:
Review Article

Article History:
Received: Mar. 03, 2025
Revised: Apr. 03, 2025
Accepted: May. 20, 2025
Published Online: July. 27, 2025

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A B S T R A C T

Objective: Curry leaves (*Murraya koenigii*) are tiny, fragrant deciduous tree native to tropical and subtropical regions. Known for its aromatic leaves It is extensively utilized in culinary dishes and conventional treatments for its blood-thinning, antidiarrheal, and anti-inflammatory properties, alongside its role in fragrance and oil industries.

Methodology: A complete database search was undertaken using terms such as' pharmacology ' 'antidiabetics,' 'anticancer,' '*Murraya koenigii*', 'photochemistry' to locate relevant material. Databases such as Google Scholar, SID, Magiran, PubMed, and Scopus were utilized to look for relevant publications, particularly ethnobotanical research on the issue.

Result: In traditional medicine, plant extracts such as *M. koenigii* have been found to have healing properties. *M. koenigii*, originating from India, has been found in various parts and is rich in compounds that exhibit potent biological processes, such as antioxidant, anti diabetic, anticancer, anti-inflammatory, and neuroprotective effects.

Conclusion: *M. koenigii*, a plant with medicinal properties, contains bioactive compounds with anticancer and health-promoting effects, including cancer prevention, immune system modulation, antioxidant effects, and neurological disorders.

Keywords: *Murraya koenigii*, Pharmacology, Photochemistry, Anticancer, Anti diabetics

➢ **How to cite this paper**
Bhargavi S , Ashok Kumar BS, Chaithanya A , Hema PM. A Review on Exploring the Medicinal Potential of *Murraya koenigii*: Photochemistry, Pharmacology, and Therapeutic Benefits. Plant Biotechnology Persa 2025; 7(3): 12-28.

Introduction

India is home to fourteen different species of the genus Murraya, including *Murraya paniculata* (Linn) and *M. koenigii* Spreng. Table 1 provides a detailed description of the morphological properties of Murraya Koenigii Linn, also referred to as Neem Meethi. Up to six meters in height, M. koenigii is a fragrant, small deciduous tree or shrub. [1]. In traditional medicine, its fragrant leaves are used as a blood thinner, febrifuge, antiemetic, antidiarrheal, and anti-dysentery medication. It is grown up to 1500 meters above sea level. [2] It is also utilized in savory, tonic, cleansing, and stomachic ingredients in curries and chutneys. The companies that make soap and fragrances smear oil on wounds. Even though the plant prefers tropical and subtropical temperatures, it may survive in other regions by relocating pots to safe, warm places in the winter and keeping humidity levels high in the summer [3]. Asian cuisines employ curry leaves, a ubiquitous leaf spice, to improve the flavor of their dishes. This review attempts to identify the characteristics of the Murraya koenigii plant,

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[DOI: 10.61186/pbp.7.3.13]

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including its health benefits and pharmacological, phytochemical, and pharmacognostic qualities. [4,5, 6]

Methodology

To find pertinent information, a thorough database search was conducted using keywords like "pharmacology," "antidiabetics," "anticancer," "*Murraya koenigii*," and "photochemistry." We searched databases including Google Scholar, SID, Magiran, PubMed, and Scopus to find pertinent papers, especially ethnobotanical studies on the topic.

Results and Discussion

Taxonomic Classification of *Murraya koenigii*

Based on the conducted examination, *Murraya koenigii* (commonly known as curry leaf) is taxonomically classified as follows:

Kingdom: Plantae; Subkingdom: Tracheobionta (vascular plants); Super division: Spermatophyta (seed plants); Division: Magnoliophyta (flowering plants); Class: Magnoliopsida (dicotyledons); Subclass: Rosidae; Family: Rutaceae; Genus: *Murraya* J. Koenig and Species: *Murraya koenigii*

These results indicate that the studied plant belongs to the Rutaceae family and is classified among flowering dicotyledonous plants. It is one of the well-known species within the *Murraya* genus (table 1).

Table 1: Morphological Characteristics of *M. koenigii*

Sl.No	Morphological parameters	M. koenigii
	Tree	Shrub or tree 6min height and 15–40cmin size its trunk.
	Bark	There is white bark underneath it, and the bark is grey with longitudinal striations.
	Leaf	15–30 cm long, bipinnately compound leaves with uneven edges and 11–25 leaflets alternating on the rachis
	Flower	Each terminal cyme has 60–90 blooms and is bisexual, white, pleasantly perfumed, stalked, funnel-shaped, and complete, with a diameter of 1.12 cm.
	Fruits	Prism-black, mature, ovoid to subglobose, wrinkled, or rough with glands, measuring 2.5 cm in length and 0.3 cm in diameter; seeded
	Seeds	It weighs up to 445 milligrams, is green spinach, and is 11 mm in length and 8 mm in diameter. [16]. Kingdom of Plants

M. koeniigii's traditional applications

Curry leaves, dried leaves powder, aromatic oils, and fresh Uses for leaves include soap, aromatherapy, and a range of culinary preparations.[6] They are also utilized in hair tonics and conventional remedies for bodily aches, fever, diarrhea, nausea, vomiting, renal discomfort, as well as antifungal and antiemetic medications. Curry leaves are good for individuals of all ages and are high in iron, calcium, and vitamins A, B, C, and B2. [7] Women with osteoporosis, calcium deficiencies, and other associated conditions benefit most from them. [8] Curry leaf juice relieves nausea and

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vomiting from indigestion and fat overconsumption when mixed with juice from limes and sugar. Curry leaves are also utilized as antidepressants, antifungals, blood purifiers, anti-inflammatory, and antidiarrheal treatments. [9]. Figure 1 illustrates *Murraya koenigii's* pharmacological actions.

Medical use of M. koeniigii

The bark, roots, and leaves of curry leaves plant are employed as antiemetics, tonics, and disease-remediation agents. [9] The root liquid is used to relieve renal pain, while the leaves help reduce fever. In addition to relieving irritation and inflammation, the leaves and roots include analgesic, anthelmintic, piles cure, body heat reduction, and thirst quencher properties. [11] They can also cure leukoderma and blood issues. When boiled with milk, the resultant paste may be used to treat poisonous bites and eruptions, while raw green leaves can be used to cure diarrhea [12].

Chemical composition of *M. koenigii*

Numerous chemicals composition is present, such as polyphenols, terpenoids, alkaloids, and flavonoids, in the leaves, roots, and stem bark of *M. koenigii* [11,12]. Moisture, protein, carbs, fat, sugars, starch, and crude fiber are all important components of leaves. They also include calcium, magnesium, salt, thiamine, vitamin B3, and B-carotene. 1.82%, 13.06%, 1.35%, 27.33%, and 33.45% are the values for the alcohol-soluble extract, ash, and acid-insoluble ash, respectively. There are also many beneficial terpenoids, flavonoids, essential oils, and carbazole alkaloids in the plant. The fruits, seeds, roots, leaves, and stem bark all have significant nutritional value [13]. Table 2 lists the main pharmacological and bioactive chemicals of M. koenigii, whereas Table 3 lists the phytochemical substances that have been found from the plant.



Fig 1: Activities of Murraya koenigii in pharmacology

Oxidative stress and tissue damage are caused by reactive oxygen species (ROS), which are produced by cellular metabolism and outside stressors. Age-related illnesses including cancer, atherosclerosis, and arthritis are exacerbated by high ROS concentrations, which harm lipids, proteins, and nucleic acids [13]. Natural antioxidants derived from plants have shown promise as remedies for a number of illnesses, such as cancer, heart disease, and neurological conditions. Therefore, controlling the production of ROS is crucial to maintaining overall health [14].

The production of reactive oxygen species (ROS) by cellular metabolism and external stimuli results in oxidative stress and tissue damage [15, 16, 17]. These compounds exhibit exceptional antioxidant properties, with leaf extracts reaching 80% of their capacity. Ethanolic extracts have the highest capacity for scavenging activities. The antioxidant properties of M. koenigii extracts are most potent within benzene fractions, followed by acetone and alcohol solution extracts and aqueous solution extracts [18-21]. Yogesh et al. conducted assays to measure the antioxidant activity of *M. koenigii* berry extracts, confirming that it functions better as a free radical scavenger than other common antioxidant substances. The flavonoids and phenolic chemicals found in *M. koenigii's* crude extracts are probably what give them their antioxidant qualities. According to the investigations, *M. koenigii* extracts show significant levels of antioxidant

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activity, indicating that it may be a natural source of effective antioxidant compounds for human illnesses brought the result of oxygen species that are reactive (ROS) [22-25].

Free radicals are chemical species with unpaired electrons that affect biological systems through intermediate metabolic processes that regulate cellular development, glucose metabolism, and proliferation, such as reactive oxygen species (ROS) and reactive nitrogen species (RNS) [26-28]. They may result in negative effects such protein S-nitrosylation, genetic mutations, alterations in cell membrane permeability, and loss of enzyme activity. Free radicals continuously destroy DNA, causing 75,000 to 100,000 damage events per cell per day [29]. Lipids, proteins, RNA, and DNA can all be harmed by an increase in the quantity of free radicals. It has been shown that M. koenigii leaf extract may have antioxidant properties and offer protection against oxidative stress brought on by diabetes [30,31].

The main source of high-energy metabolism in cells, the mitochondria, are essential for controlling programmed cell death, maintaining calcium homeostasis, and scavenging free radicals [32,33]. Mitochondrial injury can lead to DNA damage, altered mitochondrial shape, reduced calcium generation, increased reactive oxygen species (ROS), reduced ATP synthesis, and cell death. The majority of ROS are generated by mitochondrial complexes I and III because NADH and FADH2 release electrons into the electron transport chain (ETC). The generation of high-energy molecules is reduced by mitochondrial dysfunction, which is often linked to aging and chronic disorders [34]. Because complex I inhibition and oligomeric pores cause excess ROS production, mitochondria also have a major impact on the survival of neuronal cells. The neuroprotective qualities of isolongifolene and similar chemicals from M. koenigii have been assessed in recent studies [35, 36, 37].

Tissue damage, cell damage, infections, and metabolic alterations can all cause inflammation, which is a biological reaction. Microglia, astrocytes, macrophages, mast cells, ependymal cells, and others are important elements in neurological illnesses [38, 39]. Neuronal support cells called microglia aggressively combat inflammation and eliminate infections and injured neurons. [40] *M. koenigii* leaves have shown potent analgesic and anti-inflammatory effects in experimental settings, such as carrageenan-induced hind paw edema in albino rats [41]. Mice given formalin and acetic acid experience less discomfort when M. koenigii leaf extracts are administered [42]. A carbazole alkaloids-rich extract of *M. koenigii* curry leaves raises Nrf2 expression, lowers nitrotyrosine, myeloperoxidase, IL-1, and COX-2 production, and dramatically lowers inflammatory cytokine activity [43]. Leaf extracts from M. koenigii have also been demonstrated to inhibit TNF and IL-6 production in human peripheral blood mononuclear cells during LPS-induced inflammation [42,43].

The extract from *M. koenigii* and its active ingredients control apoptosis, a vital physiological process that results in cell self-destruction [44]. In D.L. Dexter colon cancer cells, murtazoline and O-methylmurrayamine increase anticancer activity by targeting the cell survival pathway [45]. *M. koenigii* leaves contain mahanine and isomahanine, which cause oral squamous cell carcinoma cells to undergo autophagic flow [46]. Girinimbine causes ovarian and hepatocellular carcinoma cells to undergo apoptosis and growth inhibition. Koenimbin prolongs the MCF-7 cancer cells' pro-apoptotic mechanisms, which results in phosphorylation, catenin accumulation, NF-kB activation, and apoptotic cell death [47].

It has been determined that *M. koenigii* possesses antifungal qualities, and its essential oil works well against fungus [48]. Its antifungal activity is facilitated by its diverse phytochemicals, which include flavonoids, terpenoids, and alkaloids. In vitro studies support its traditional use in treating diarrhea and skin issues. Bioactive compounds in M. koenigii inhibit mycelial growth and promote antifungal activity against various pathogens, including *Penicillium* and *Aspergillums*. The ethanol extract alters fungal morphology, creating short branches with swollen tips [49].

The uncontrolled use of antibiotics leads to bacteria becoming resistant to multiple drugs, reducing treatment effectiveness. This has led to a growing interest in alternative, natural treatments like herbal medicine [49]. *E. Coli*, *Staphylococcus*, *Streptococcus*, and *Proteus* are among the microbes that *M. koenigii* extracts have been shown to have antibacterial qualities against [50]. Against Klebsiella pneumonia and Staphylococcus aureus, compounds pyranocarbazoles from *M. koenigii* shown antibacterial ability. Therapeutic effectiveness against bacteria resistant to many drugs was established using *M. koenigii*-derived green generated silver nanoparticles [53]. *M. koenigii* essential oil greatly decreased the production of Pseudomonas aeruginosa biofilms and demonstrated antibiofilm action against the bacteria. Spathulenol, cinnamonaldehyde, and linalool are antibiofilm chemicals that were found in Murraya koenigii essential oil, according to GCMS investigations. *M. koenigii* extracts also demonstrated effectiveness against uropathogenic bacteria and Mycobacterium species, comparable to first-line anti-tuberculosis drugs [52].

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Global liver disease is a significant issue with limited effective treatmentsFor generations, people have utilized plant extracts, including M. koenigii, to cure a variety of ailments, including shielding the liver from toxins [48]. Animal studies have shown that *M. koenigii's* crude extracts can protect against liver damage from excessive alcohol consumption, treat chronic liver impairments, and maintain oxidative status. Experiments on *M. koenigii* in cell and rat models have shown positive effects against liver damage, maintaining antioxidant levels and cell integrity while reducing liver marker activities in rats pre-treated with the extracts [53,54].

The immune system is essential for preserving the health of an organism because it keeps pathogens out. An extract of M. koenigii leaves in methanol shown immunomodulatory action, promoting humoral immunity and phagocytic function, according to a study on the immunological responses to ovalbumin. Additionally, the extract shown potential in controlling diabetic mice's oxidative stress metabolism and murine immunology. This shows that leaf extracts from *M. koenigii* may have immunomodulatory effects and control the metabolism of oxidative stress in diabetic mice [55, 56].

It has been shown that the leaf extract from *M. koenigii* exhibits nephroprotective properties in diabetic rat models. Urine output, urinary creatinine levels, total serum protein, serum electrolytes, and blood urea nitrogen all remain within acceptable limits [48]. In addition, the extract protects against unilateral renal ischemia reperfusion damage while maintaining renal myeloperoxidase activity, antioxidant activity, and kidney histopathological integrity. Experimental research revealed lower levels of oxidation of lipids, plasma creatinine, and plasma urea nitrogen [34]. By maintaining glutathione and superoxide dismutase levels, the extract also demonstrated effectiveness against cyclophosphamide-induced nephrotoxicity. In rats with diabetes, the extract also promoted tissue regeneration [57].

Medicinal plants, such as M. koenigii, are increasingly being used to manage diabetes due to their affordability and potential anti-diabetic properties. The plant contains alkaloids that inhibit the aldose reductase enzyme and improve glucose utilization, making it a promising candidate for treating type 2 diabetes [27]. *M. koenigii* also has antioxidant properties that reduce inflammation and improve insulin sensitivity in rats, making it a promising candidate for treating diabetes mellitus [28]. Overall, these antidiabetic and antioxidant effects make *M. koenigii* a promising option for diabetes management [58].

In vivo models, rodent cancer cell lines, and HeLa cancer cells, extracts from M. koenigii have shown anticancer activity, indicating that the herb may have anticancer potential. It slows the growth of breast cancer cells and decreases neoplasms, especially in the colon. The cytotoxic action of the alkaloid extract is demonstrated by its IC50 of 14.4 µg/mL [37]. Makanine and isomahanine are chemicals that have anticancer efficacy against oral squamous cell carcinoma and inhibit endogenous 26S proteasome activity in breast cancer cells [58,59].

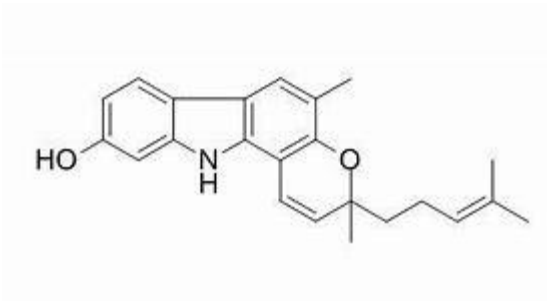
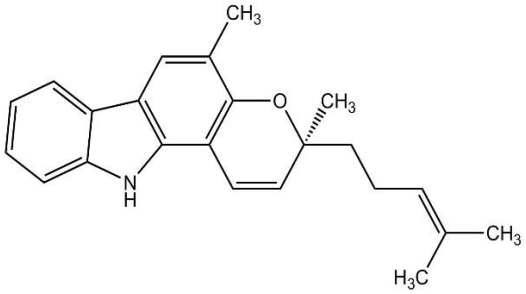
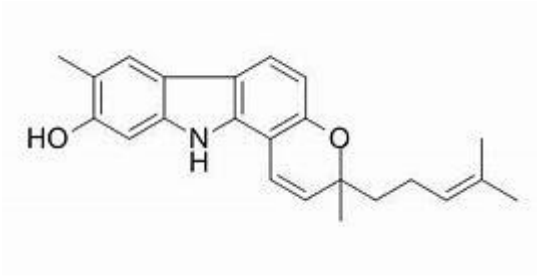
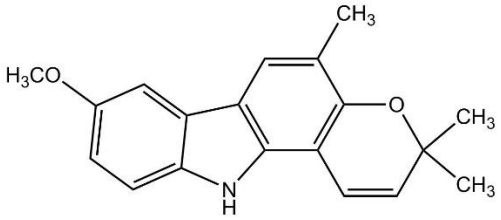
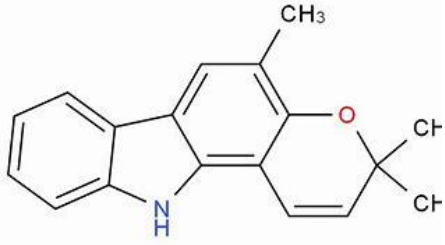
Brain disorders including Parkinson's and Alzheimer's have been treated using extracts from *M. koenigii* leaves [60,61]. Because of their neuroprotective qualities, they can avoid reserpine-induced orofacial dyskinesia. In the forebrain area, *M. koenigii* suppresses LPO and stabilizes antioxidant enzymes. Treatment prevents reserpine-induced behavioral impairments and restores protective enzyme levels. One of M. koenigii's compounds, isolongifolene, shows neuroprotective properties against oxidative stress, apoptosis, and mitochondrial dysfunction. Moreover, It suppresses caspases-3, -6, -8, and -9 as well as Bax expression [62].

In vivo, an amethanolic extract of *M. koenigii* was demonstrated to offer defense against chromosomal damage brought on by radiation and cyclophosphamide. Exposure to radiation increases all types of abnormalities, including chromatid fragmentation and chromosomal, ring, and dicentric breakdowns. Using a methanolic extract of M. koenigii, absorptions were significantly reduced prior to radiation therapy. *M. Koenigii* In vivo, chromosomes are protected from radiation and cyclophosphamide damage by a methanolic extract of M. koenigii. Radiation causes several anomalies, including chromosome fragmentation and ring, dicentric, and chromosomal breakage. The importance of administering a methanolic extract of *M. koenigii* prior to radiation therapy [64].

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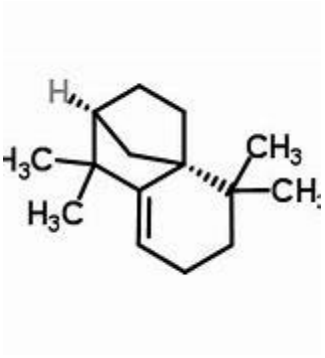
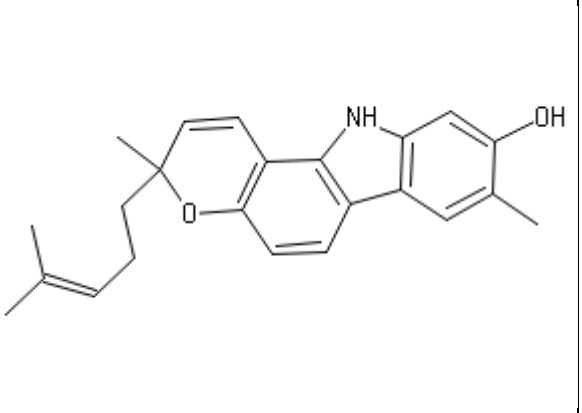
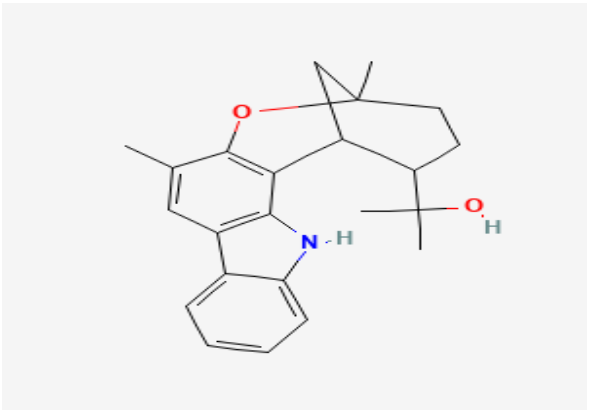
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Table2: The primary bioactive substances and pharmacological actions of M. koenigii

Sl. No	Constituent	Constituent Structure	Action	Reference
	Mahanine		Cytotoxicity, anti-microbial, and anti-cancer	[21]
	Mahanimbine		Cytotoxicity, anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidemic	[22]
	Isomahanine		Cytotoxicity, anti-oxidant, anti-microbial, anti-diabetic,and hyperlipidemic	[23]
	Koenimbine		Cytotoxicity, and anti-diarrhoea	[23,24]
	Girinimbine		Anti-tumor	[25]

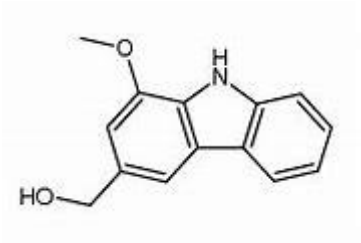
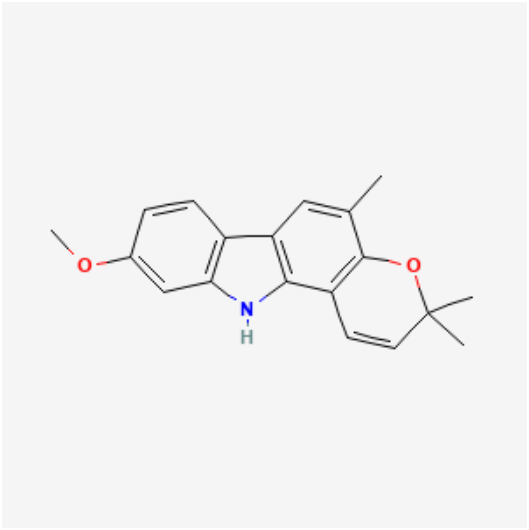
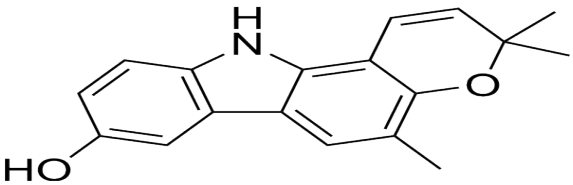
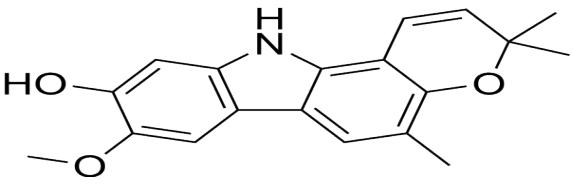
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	Isolongifolene		Anti-oxidant and neuroprotective	[25,26]
	Pyrayafoline D		Anti-cancer and anti-bacteria	[27]
	Murrayafoline		Cytotoxicity and anti-inflammatory	[28]
	Murrayazoline		Cytotoxicity and anti-tumor	[29]

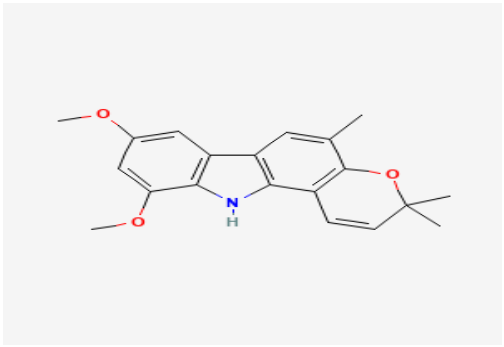
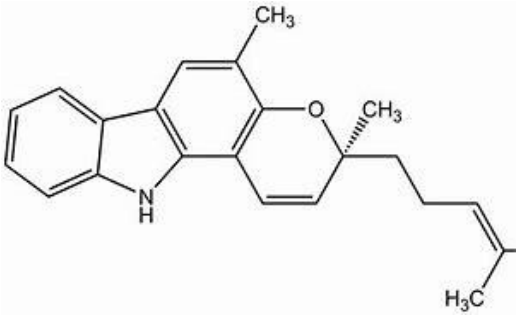
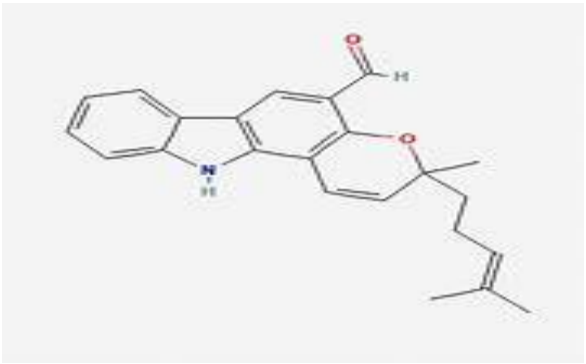
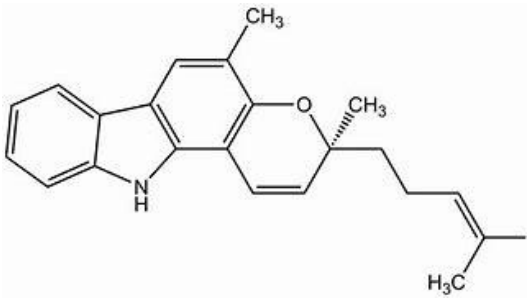
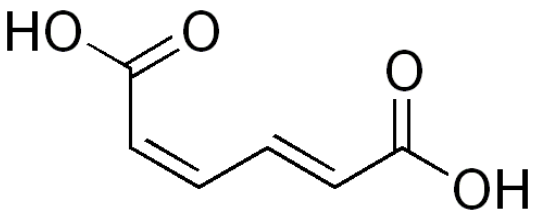
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	Koenoline		cytotoxicity	[30]
	O-methylmurrayamine		Anti-oxidant and neuroprotective	[31]
	Koenine		Anti-oxidant	[31,32]
	Koenigine		Anti-oxidant	[33]

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	Mukonicine		Anti-oxidant	[34]
	Mahanimbinine		Anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidaemia	[35]
	Murrayacinine		Anti-oxidant, anti-microbial, anti-diabetic ,and hyperlipidaemia	[36]
	Mahanimboline		Cytotoxicity, anti-oxidant, anti-microbial, anti-diabetic, and hyperlipidaemia	[37]
	Mukoeic acid		Anti-oxidant	[38]

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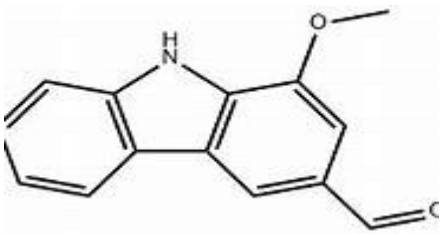
	Murrayanine		Anti-oxidant	[38,39]

Table 3: Phytochemical compounds identified from *M. koenigii*

Compound	Molecular Formula	Plant Part
Mahanine	C23H25NO2	Leaves, stem bark, and seeds
Mahanimbine	C23H25NO	Leaves, roots, seeds, and fruits
Murrayanol	C24H29NO2	Leaves, roots, and fruits
Koenimbine O-	C19H19NO2	Leaves, roots, and fruits
Methymurrayamine A	C19H20NO2	Leaves
Koenigicine	C20H21NO3	Leaves
Koenigine	C19H19NO3	Leaves and stem bark
Murrayone (Coumarine)	C15H14O4	Leaves
Mahanimbicine	C23H25NO	Leaves
Bicyclomahanimbicine	C23H25NO	Leaves
Phebalosin	C15H14O4	Leaves

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Isomahanimbine	C23H25NO	Leaves and roots
Koenimbidine	C20H21NO3	Leaves and roots
EuchrestineB	C24H29NO2	Leaves
BismurrayafolineE	C48H56N2O4	Leaves
Isomahanine	C23H25NO2	Leaves, seeds, and fruits
Mahanimbinine	C23H27NO2	Leaves and seeds
Girinimbilol	C18H19NO	Leaves
Pyrayafoline-d	C23H25NO2	Leaves and stem bark
Glycozoline	C14H13NO	Leaves
Cyclomahanimbine	C23H25NO	Leaves
Isolongifolene	C15H24	Leaves
Mukonal	C13H9NO2	Stems
Mukeicacid	C14H11NO3 9-	Stems
9-Carbethoxy-3-methylcarbazole	C16H15NO2	Roots and stems
9-Formyl-3-methylcarbazole	C14H11NO	Roots and stems
Murrayazolinol	C23H25NO2	Stemsbark
Mahanimbinol	C23H27NO	Stemsbark
Mukoeicacid	C14H11NO3	Stembark
Osthol	C15H16O3	Stembark

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Umbelliferone	C9H6O3	Stembark
MurrayafolineA	C14H13NO	Roots
MurrayakonineA	C37H36N2O2	Leaves and stems
MurrayakonineB	C23H23NO2	Leaves and stems
MurrayakonineC	C24H25NO3	Leaves and stems
MurrayakonineD	C23H25NO2	Leaves and stems
Girinimbine	C18H17NO	Roots, stembark, and seeds
Murrayacine	C18H15NO2	Stem and bark
Murrayazoline	C23H25NO	Stem and bark
(M)-murrastifoline-F	C28H24N2O2	Roots and stembark
3-Methyl-9H-carbazole-9-carbaldehyde	C14H11NO	Roots and stembark
Bismahanine	C46H48N2O4	Roots and stembark
BikoeniquinoneA	C27H20N2O3	Roots and stembark
Bismurrayaquinone	C26H16N2O4	Roots and stembark
3-Methylcarbazole	C13H11N	Roots
Flavonoids		
Quercetin Apigenin Kaempferol Rutin Catechin Myricetin 4-O--d-Rutinosyl-3 Methoxyphenyl 1-propanone	C15H10O7 C15H10O5 C15H10O6 C27H30O16 C15H14O6 C15H10O8 C22H32O12	Leaves Leaves Leaves Leaves Leaves Leaves Leaves

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1-O--d-Rutinosyl-2(R)-ethyl-1-pentanol	C19H36O10	Leaves
8-Phenylethyl-O--d-rutinoside	C20H30O10	Leaves
Terpenoids		
BlumenolA	C13H20O3	Leaves
IcarisideB1	C19H30O8	Leaves
Loliolide	C11H16O3	Leaves
Squalene	C30H50	Leaves and bark
β-sitosterol	C29H50O	Leaves and bark
Polyphenols		
Selin-11-en-4-ol	C15H26O	Leaves and bark
2-hydroxy-4-methoxy-3,6-dimethylbenzoic acid	C10H12O4	Bark

Multiple biochemical and cellular mechanisms are involved in the intricate wound-processing healing, which returns the structure and function of injured areas. Histopathological investigations have demonstrated that M. koenigii leaves promote collagen production and increase wound contraction, which enhances wound healing in male albino rats [64].

There is a 250–400 mg/kg water extract from leaves that prevents stomach ulcers and sores [65].

The effectiveness of carbazole alkaloids, specifically girinimbin and girinimbilol, that have been isolated from leaves against Trichomonas gallinae is demonstrated by their IC50 values of 1.08 and 1.20 mg/mL [66].

Male Wistar rats given *M. koenigii's* ethanol leaf extract orally for 30 days effectively lower body weight, cholesterol, and triglycerides while regulating blood sugar levels [67].

Research has demonstrated that a water extract from *M. koenigii* leaves reduces diarrhea in test animals, while the chemical koenimbine, found in the seeds, inhibits diarrhea in rats [68,69].

Curry leaves may help with gingivitis [70], liver and renal functions [71], and hypertension [72], but no substantial clinical research have been done on them as of yet. Despite a large number of research investigating *M. koenigii's* neuroprotective potential, preclinical and clinical efficacy are lacking, requiring immediate clinical trials to demonstrate this plant's neuroprotective potential. 3 to 6 g has been used safely. Curry leaves contain little quantities of iron, zinc, manganese, and selenium, but they are rich in calcium, potassium, magnesium, and phosphorus and low in lead, mercury, and cadmium [73]. *M. koenigii* leaf samples showed no signs of disease or mortality after rats were fed the ethanolic extract for 28 days. Up to 500 mg/kg of medicine may be used without harming the structure of the organs [74]. There were no observable changes in behavior, toxicity, or mortality in the mahanine-enriched fraction (MEF). For mice, methanolic leaf extract and crude leaf powder up to 9000 mg/kg were safe [75].

It was discovered that the extract included carbohydrates, phenolic chemicals, alkaloids, glycosides, flavonoids, and steroids. At 2000 mg/kg, it was determined to be safe. At 250 mg/kg, the extract had a hypotensive impact; at 150 mg/kg, it demonstrated an antihypertensive effect. A significant hypotensive impact was seen when the extract and amlodipine were combined, indicating a synergistic interaction that led to death [76]. The hypoglycemic properties of curry leaves are well-known, and they may mix with antidiabetic medications to produce dangerously low blood sugar levels [77] The carbazole alkaloids found in

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curry leaves, such as koenine, bicyclomahanimbicine, and cyclomahanimbine, been proven to have several different pharmacological properties, including as antibacterial, antioxidant, and antidiabetic effects [77].

The antioxidant qualities of curry leaves may interact with drugs that the liver metabolizes, changing how they are eliminated and perhaps raising their levels in the body.

Due to their potential minor blood-thinning action, curry leaves may increase the risk of bleeding when used with anticoagulants like warfarin [78]. Curry leaves can cause allergies in certain people, so it's critical to be mindful of any side effects including skin rashes, itching, or breathing difficulties. Curry leaves may help prevent kidney damage, according to some research, but if you have renal issues or are taking any drugs that alter kidney function, you should exercise caution [78].

Conclusion

The photochemistry, pharmacological characteristics, and therapeutic applications of *M. koenigii*, a plant that includes a variety of bioactive chemicals with anticancer and other health-promoting qualities. Antioxidant effects, immune system modulation, and cancer prevention are among the characteristics of Substances of *M. koenigii*. They are responsible for these functions because they affect several cells signaling pathways. Derivatives of *M. koenigii* can also benefit neurological conditions linked to oxidative stress.

Declaration

No organization provided the author any assistance for the work that was turned in.

Ethics approval

The Declaration of Helsinki's tenets were followed in the conduct of this investigation.

Competing interests

Regarding this article's content, the author has declared no conflicting interests.

Consent to participate and funding: nil.

Author contribution

Acknowledgements: I would like acknowledge our Principal, RLJCOP for supporting me and completing my work.

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