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A Review On The Pharmacognostic Evaluation, Phytoconstituents, And Medicinal Uses Of Murraya Paniculata

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ABSTRACT

Murraya paniculata (Rutaceae), commonly known as orange jasmine, is an evergreen shrub of considerable medicinal and economic importance. Members of the Rutaceae family are widely recognized for their edible fruits and essential oils, while M. paniculata has gained attention for its diverse pharmacological activities. Literature on the pharmacognostic features, phytochemical composition, and ethnomedicinal uses of M. paniculata was reviewed from various scientific databases. Reports indicate that its leaf extracts contain phenolic compounds, oxygenated flavonoids, flavanones, sesquiterpenoids, polymethoxy glycosides, and coumarins. Essential oils are rich in cyclocitral, methyl salicylate, trans-nerolidol, cubenol, isogermacrene, cadinol, and cubeb-11-ene. Traditional medicine describes the therapeutic use of its bark, leaves, and flowers. Pharmacological studies confirm multiple biological properties, including anti-diabetic, anti-obesity, antibacterial, antioxidant, anti-implantation, cytotoxic, anti-diarrheal, antidepressant, and anxiolytic effects. The wide spectrum of activities suggests its potential as a source of novel therapeutic agents. Murraya paniculata exhibits remarkable pharmacognostic and phytopharmacological potential. Further scientific investigations focusing on its active constituents may contribute to the development of new drugs for managing infectious and metabolic disorders, thereby expanding its clinical relevance.

Keywords: Herbal plants, Murraya paniculata, Pharmacognosy, Therapeutic uses.

1. INTRODUCTION

Herbal products are becoming more and more popular in both developed and developing countries. The use of medicinal plants in traditional and folk medicine dates back thousands of years, and their significance in the treatment of mild to moderate and chronic illnesses is only increasing. Often referred to as orange jasmine, honey bush, or kamini, Murraya paniculata (MP) is a traditional medicinal plant belonging to the Rutaceae family. India, Sri Lanka, southern China, Thailand, and the Malesian area, which extends eastward to northeastern Australia and Caledonia, are its principal habitats. Twelve species of evergreen shrubs make in the genus MP. It may prevent Diaphorina citri from migrating into commercial citrus orchards, which is important for improved huanglongbing control. This plant is used to treat rheumatism, headaches, bruising, gastralgia, stomachaches, skin irritation, and swelling. Additionally, it is used to treat snake bites and increase menstruation flow. Additionally, the herb is used to alleviate toothaches. Among other trustworthy databases, the review was conducted using Science Direct, Elsevier, Research Gate, PubMed, and Google

Scholar. MP was specifically discussed in this study, with a focus on its pharmacological properties and freshly identified phytoconstituents.[1-7]

2. DESCRIPTION

The plant has a potential height of 8–12 feet. The oval-shaped crimson fruits and fragrant white blooms of MP are found on its taproot (Fig. 1). Five to one inch is the fruit's length. MP leaves are 2–11 cm long and 1-1.5 cm broad, with an egg-like form. The leaves are dark green in hue and have a spicy, bitter flavor. They also smell quite nice. Their exterior is glossy and smooth. Mesophyll, stomata-free epidermis, and epidermis are all places where leaves can be found. The powdered MP leaves have rosette-shaped stomata, anticlinal cell walls, and a hair-covered lower epidermis [8-9].

Fig. 1: Murraya paniculata plant

MP is widely grown in tropical nations and under glass in temperate ones. Approximately 200 meters is the optimal elevation since MP is cultivated on calcareous or basalt soils. The blooms are picked between March and June (Table 1). With two IR sections of 27,033 bp separating the major and small single-copy portions of 87,605 and 18,609 bp, respectively, MP's chloroplast genome is 160,280 bp long. 38.61% is the sample's GC percentage. De novo assembly and annotation showed that there were 85, 29, and 8 protein-coding, tRNA, and rRNA genes, respectively, indicating the presence of unique genes [10-11].

Table 1: Botanical classification of Murraya paniculata

Kingdom	**Plantae**
Phylum	Charophyta
Class	Equisetopsida
Subclass	Magnoliidae
Superorder	Rosanae
Order	Sapindales
Family	Rutaceae
Genus	Murraya
Species	Paniculata

3. PHYTOCONSTITUENTS OF DIFFERENT PARTS OF MP

Flavonoids, alkaloids, proteins, carbohydrates, phenolic compounds, and amino acids are among the many phytoconstituents that have been identified. Numerous portions of the plant have yielded different chemical substances [12-33].

Leaves, shoots and twigs

Coumarin compounds including murrayanone and murraculatin are present in MP leaf extracts [15]. CHCl3 extracts of MP leaves contained eight highly oxygenated flavones: 5-hydroxy-6,7,3’,4’,5’-tetramethoxyflavone (5-O-desmeth-ylnobiletin), 5-hydroxy-6,7,8,3’,4’,5’-tetramethoxyflavone (5-hydroxy-6,7,8,3’,4’,5’-tetramethoxyflavone), 5-hydroxy-6,7,8,3’,4’,5’-trihydroxyflavone, and 5,3’,5’-trihydroxy-6,7,4’,5’-trihydroxyflavone . After being extracted from MP leaf extracts, two flavonoids—5,6,7,8,3',4',5'-heptamethoxyflavone and 3,5,7,8,3',4',5'-heptamethoxyflavone—exhibited inhibitory action against human carbonic anhydrase isozyme II (hCAII) at dosages of 10.8 and 21.5 M, respectively. Additionally, five,8,3'-trihydoxy-6,7,4'-trimethoxy flavone 8-O-beta glucopyranoside and five,8-dihydoxy-6,7,3',4'-tetramethoxy flavone 8-O—beta-glucopyranoside are glycosides of flavone methyl ethers found in leaf and shoot extracts. Using the HPLC-DADESI-MS/MS analytical technique, polymethoxylated flavonoids were extracted from the leaf extracts. The leaf and twig extracts revealed a high concentration of 14 secondary metabolites in total. Spiroquinazoline alkaloids identified from Eupenicillium spp. leaves include alanditrypinnone, alantryphenone, alantrypinene-B, and alantrylewnone. 2-O-ethylmurrangatin, a secondary leaf metabolite, exhibited modest respiratory burst inhibitory action and lipoxygenase inhibition.

Root

The indole alkaloid derivatives found in MP root extracts, including paniculidines (D-F) and their six recognized analogs, were identified using the HRESIMS, UV, IR, and NMR spectroscopy methods. Additionally, 34 recognized analogs of coumarin derivatives designated as panitins A–G were discovered . Root bark samples extracted with acetone have revealed the presence of coumarins such as minumicrolin isovalerate, murralonginol isovalerate, murrangatin isovalerate, chloculol, and paniculol, an indole alkaloid. Using the H NMR (270 MHz) spectroscopic technique, the structures of coumarins were determined. Another novel dimeric indole alkaloid that has been discovered and shown to have antiimplantation properties is yuehchukene, which is made from root extracts.

Flowers

Known coumarins such as scopoletin, scopolin, murracarpin, and 5,7-dimethoxy-S-(3'-methyl-2'-oxobutyl) are present along with coumarins such as (-)-murracarpin, omphalocarpin, and murrayacarpin-A and -B. The flavonoid 3,5,7,3',4',5'-hexamethoxytlavone, the indole alkaloid murrayaculatine, the coumarin, and mupanidin were all isolated from floral extracts.

Fig. 2: Murraya paniculata flower

Aerial parts

Coumarins like murrmeranzin, murralonginal, minumicrolin, murrangatin, meranzin hydrate, and hainanmurpanin are found in MP's aerial portions. Anti-cholinesterase properties of minumicrolin compounds were found. The 48 types of volatile chemicals included in ethanolic extracts were identified using GS and GS-MS.

Fruits

A water-soluble gum polysaccharide was isolated from MP fruits. Using NMR data, periodate oxidation studies, methylation tests, and hydrolytic experiments, the polysaccharide was shown to be highly branched. α-copaene, -zingiberene, β-caryophyllene, germacrene D, and α-humulene are among the fruit's essential oils. An ethanolic MP extract in the form of a colorless oil has been shown to contain a chemical component known as paniculacin. Phytochemical analysis of the essential oil confirmed the 58 reported components. The principal constituents were 4-methylene-6-(1-propenylidene), cyclo-octene, germacrene D, spathu-lenol, caryophyllene oxide, and -elemene.

Figure 3: Murraya paniculata fruits

4. PHARMACOLOGICAL ACTIVITIES

Analgesic activity

Swiss albino rats were used to test MP bark extracts' analgesic effects, which were induced by dosages of 200 and 400 mg/kg body weight. According to other research, leaf extracts showed antinociceptive properties in mice and rats [34, 36].

Anti-diarrheal, bronchodilator, and vasodilator activity

The aqueous ethanolic extracts of MP leaves demonstrated calcium channel blocking properties in rabbit tissue preparations, which is useful in the treatment of diarrhea. The extract's anti-diarrheal effect EC50 was 0.03610 mg/mL, while its spasmolytic efficacy was found at a concentration of 0.01-0.3 mg/mL. Using isolated tissue preparations, the leaf extract also demonstrated vasodilator and bronchodilator effects in rabbits. In a different investigation, the ethanolic MP extract shown possible anti-diarrheal efficacy when compared to castor oil, significantly lowering the incidence and severity of diarrhea in a model of experimental mice [37,38].

Anti-inflammatory activity

Following nitric oxide inhibition at a concentration of 3μM, 5-hydroxy-6,7,8,3’,4’-pentamethoxyflavone (P8), 5,7,3’,4’,5’-tetramethoxyflavone (P3), and 5,7,3’,4’,5’-pentamethoxyflavone (P1) were the three kinds of flavonoids that were isolated from MP. Several anti-inflammatory screening models were used to assess

the anti-inflammatory properties of ethanolic leaf extracts. One research examined the anti-inflammatory properties of total flavonoids of MP (TFMP) on H9c2 cells that had been exposed to high glucose. Apoptosis, inflammation, and oxidative stress were all shown to be inhibited by TFMP in different ways [38-40].

Antioxidant activity

A methanolic leaf extract's antioxidant activity was determined using DPPH scavenging and other methods. MP methanol extract was demonstrated to have a higher antioxidant capacity than trolox, the conventional antioxidant. MP extracts' antioxidant activity in ethanol, hexane, and water was examined in a different research. As per the findings, the antioxidant activity of ethanol extracts at 500 g/mL was 67.77%, while the standard reference, which was 500 g/mL of alpha tocopherol, had an antioxidant activity of 72.24% [41,42].

Antibacterial activity

Using the disc diffusion and micro-dilution techniques, the MP leaf extracts shown antibacterial efficacy against both Gram-positive and Gram-negative bacteria. High concentrations of flavonoids and phenols were present in the extracts, which support their antibacterial properties. The growth of every bacterial strain is noticeably inhibited. According to a different investigation, the floral extract displayed a zone of bacterial suppression as determined by high-media scales. Additionally, MP's essential oil had antimicrobial qualities. Ethanolic leaf extract shown antibacterial action against Klebsiella pneumoniae, an extended-spectrum β-lactamase that causes nosocomial infections and is resistant to beta-lactam medicines, according to one research [43-47].

Anticancer activity

When tested against cancer cell lines, the sterol that was extracted from MP leaves had anticancer action. An MTT test was used to assess the cytotoxic effects of sterols. One study examined the cytotoxic effects of MP leaf ethyl acetate extracts on human gingival fibroblasts and monocytes. A brine shrimp lethality experiment was used to analyze several bark extracts based on solvents. A separate research found that a flavonoid glycoside extracted from MP twigs might prevent lung cancer A549 cells from adhering, moving, and invading [48-51].

Antifungal activity

MP extracts in ethanol and water have antifungal properties against Trichophyton rubrum [45]. According to a recent study, MP leaf extracts may be able to stop the growth of fungi [52].

Anthelmintic activity

One study found that feeding MP leaves significantly boosted in vivo anthelmintic activity, suggesting that goats' gastrointestinal nematodes, growth rates, and hematological abnormalities decreased. In a different investigation, MP leaf extracts shown anthelmintic efficacy against Tricho strongylus sp., Haemonchus sp., and Cooperia sp. The infusion of 7% leaf extracts most successfully decreased adult trichostronglidae, infectious larvae, and larval development [53-54].

Antianxiety and antidepressant activity

Additionally noted were the anti-depressant and anti-anxiety effects of a number of MP leaf solvent extracts. According to earlier research, the extract reduced immobility in mice in the anti-depression paradigm and increased the number of animals entering the anti-anxiety experiment [55].

Gastroprotective and renoprotective quality

At the high dose, the ethanol extract of MP dramatically reduced the levels of hormones and cytokines, including TNF-α, IL-6, IL-1β, MTL, and GAS, and suppressed ethanol HCl-induced gastric lesions. According to the findings, MP shielded the stomach mucosa by promoting inflammation and halting the

necrosis and apoptosis brought on by ethanol-HCl. A different research discovered that the total flavonoids isolated from the leaves' ethanol extract protected the kidneys of rats with streptozotocin-induced diabetes and hyperlipidemia [56,57].

Anti-obesity activity

The ethanolic and aqueous extract of MP leaves demonstrated anti-obesity effect by inhibiting pancreatic lipase activity [58].

Anti-hyperglycemic activity

Rats with diabetes caused by streptozotocin were used to test the hydroalcoholic extract of MP leaves' anti-diabetic properties. This impact was confirmed by lower blood glucose levels in diabetic rats, which varied based on the dosage. The results showed that 400 mg/kg of extract matched the glibenclamide reference dosage. Another study examined the impact of MPE on blood glucose levels in rats with and without diabetes using an alloxan-induced diabetes model. The diabetic rats' blood glucose levels have dropped after 14 days of therapy. Rats without diabetes showed a decrease in blood glucose levels following 21 days of treatment. For 60 days, rats with alloxan-induced diabetes were administered dosages of 100, 200, and 400 mg/kg of a hydro-alcoholic extract. The extract decreased triglyceride, cholesterol, and glucose levels. Additionally, there were less morphological alterations brought on by diabetes in the kidney, pancreas, and liver. Glycated hemoglobin and fructosamine levels were also decreased [59-61].

Toxicity studies

In the past, the herb was used as a folk remedy. After an acute oral administration of the extract (2,000 mg/kg and 5,000 mg/kg single dosage), there were no fatalities or damage to the central nervous system or ANS. Rats given 100, 200, or 400 mg/kg orally subacutely for 28 days showed no changes in body weight, food consumption, or water intake [62,63].

5. CONCLUSION

For the traditional and pharmacological treatment of illnesses, MP has significant therapeutic promise. Phytoconstituents from MP extracts have not yet been the subject of much investigation. In order to protect human and animal populations from illnesses and other health problems, identified phytochemicals should also be the topic of pharmacological research to provide insight into the molecular mechanisms underlying these unreported secondary metabolites. According to published research, MP's methanol and hydroalcoholic extracts exhibited strong pharmacological action. Furthermore, a substantial amount of pharmacological research has shown that MP is effective against a variety of illnesses, including infections, free radicals, diabetes, cancer, and hyperlipidemia. Furthermore, preclinical data have not shown any negative consequences. To fully understand the phytochemicals in MP, more research on their pharmacological and toxicological properties is needed. This study recommends more pharmacological research on MP to determine its potential as a treatment for specific fatal diseases. Its pharmacological characteristics, such as its toxicity to plants, impacts on the environment, and other possible applications, must also be evaluated in future research. We also hope that this review will help researchers with their future study.

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