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MEDICINAL IMPORTANCE OF CURRY LEAF *(MURRAYA KOENIGII)*: A REVIEW

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ABSTRACT: Indian-born A is a Murraya koenigii significant culinary plant that is also used for numerous Ayurvedic medicine formulations and has been for many years. Examining the literature reveals a number of the plant's prominent pharmacological actions. The copious carbazole alkaloids found in this plant's leaves, fruits, roots, and bark have been to anti-diabetic, anti-cancer, anti-bacterial, anti-nociceptive, and antioxidant properties. The plant is said to offer a diverse array of linked medicinal properties in addition to these. This plant's phytochemistry and pharmacology require a thorough analysis of its potential as a significant therapeutic agent for the management of a variety of ailments that often affect people. The current review gives a thorough account of the phytochemical, pharmacological, clinical, and pre-clinical research done on this food plant and sheds light on its potential as a potential therapy.

Key words- Curry leaf, Murraya koenigii, traditional application, pharmacological action, phytochemistry

I. INTRODUTION

Plants have met human needs for things like food, clothes, shelter, flavors, scents, and even medications Plants have met.Plants serve as the foundation for traditional medical systems including Ayurveda, Unani, and Chinese medicine. Even several significant medications utilized today have their origins in plants. The study of ethnobotany and ethnopharmacognosy has been utilized as a guide to different sources and classes of chemicals for the search of new molecules as a result of the saturation of conventional ways of drug discovery. The richness of the tropical flora in this setting contributes significantly to its ability to generate fresh leads. [1] Hippocrates, the father of medicine, said around two thousand years ago : "Let Your medication is food, and drink be thy medicine." The founder of medicine, Hippocrates, once said, "Let Food should be used as medicine and vice versa. nourishment."Murrya koenigii (Curryleaf), an ethnomedical plant tree) that is indigenous to India demonstrates a variety of biological functions.

The Ayurvedic medical system has long employed Murrya koenigii. The current review provides a thorough account of the pharmacological studies conducted on this medicinal plant and sheds light on its therapeutic potential for the management of a number of common human illnesses.

Dig.1.1.Curry leaf

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Taxonomic Classification[02]
Kingdom-Plantae
Subkingdom- Tracheobionta
Superdivision- Spermatophyta
Division- Magnoliophyta
Class- Magnoliopsida
Subclass - Rosidae

Distribution

The author claims that Murraya koenigii is spread and grown all throughout India. It can be found from Sikkim to the Garhwal, Western Ghats, Bengal, Assam, and Travancore-Cochin regions. Under full or partial shade, the seeds germinate without restriction. Curry leaves are available. mainly in Guangdong, South Hainan, and South Yunnan, in damp forests 500–1600 metres high. Thailand, Nepal, Laos, Sri Lanka, Bhutan, and Vietnam. The curry leaves arrive in Malaysia, South Africa, and Reunion Island together with the South Indian immigration. [03]

Morphological characteristic

A tiny spreading shrub with a height of about 2.5 metres, the stem of Murraya koenigii is dark green to brownish in hue. Peeling back the bark lengthwise reveals white wood underneath. The primary stem has a 16 centimetre diameter. Each of the leaves measures about 30 centimetres longwith a reticulate venation and 24 leaflets. The bloom is white, funnel-shaped, and bisexual. Its typical diameter when fully opened is 1.12 cm, and it has a pleasant fragrance quality. The 1.4 to 1.6 cm long fruits range in shape from rectangular to spherical. in diameter and 1 to 1.2 cm in length. The fruit's pulp will be wisteria blue when fully ripe, and the fruit will be black in colour with a shiny surface. The seed will be 11mm long, spinach green, and weigh roughly 445mg. [03,04] .

Microscopy and Macroscopy studies

The leaves of Murraya koenigii L. Spreng are obliquely oval or substantially rhomboid from a macro perspective, having an acuminate, obtuse, or acute apex. The leaves feature reticulate venation, a dentate border, and an asymmetrical base, and the petiole is 20 to 30 cm long. The stomata were found to be anomocytic, and it was clear from microscopic analyses that they were dispersed on the abaxial surface and absent from the adaxial side. The epidermal layer on the transverse portion of the leaves is made up of rectangular cells and acts as the upper and lower layer's outermost covering. The author further claimed that the midrib region of the epidermis has 1 to 4 layers of collenchymatous hypodermis with 2-5 layers of chlorenchyma cells that are loaded with contents of chlorophyll, and that the upper epidermis was covered with deposition of cuticle. Oval to polygonal parenchyma cells make up the ground tissue, which has a slanted vascular bundle. This area contains calcium oxalate, which is present as sandy and prismatic crystals. [05].

II. PHYTOCHEMISTRY

The mature curry leaves have a moisture content of 63.2%, a protein content of roughly 1.15% nitrogen, a carbohydrate content of 14.6% total sugars, and a total ash content of 13.06%. The biologically active curry leaf ingredientsconsist of carbazole, resin, and oxalic acid alkaloids, and the main bioactive substances carbazole, resin, and oxalic acid koenidine, and pypayafoline.signaficant Bicyclomahanimbicine is the primary component of volatile oil and has pharmacological properties. Mahanimbicine[06].
The composition of volatile compounds found in the Murraya Koenigii essential oil from the state of Sabah, Malaysia as follows; Linalol (0.56%), trans-Sabinene hydrate (0.53%), trans-2-Cyclohexen-1-ol (0.48%), cis-2-Cyclohexen-1-ol (0.54%), para-Cymen-8-ol (10.31%), ß-Terpinol (2.52%), trans-Piperitol (0.40%), Chrysanthenyl acetate (0.39%), Lavandulyl acetate (1.67%), Bornyl acetate (1.68%), a-Copaene (0.82%),ß- Elemene (0.35%), (Z)-Jasmone (0.11%),ß-Caryophyllene (19.50%), Aromadendrene (0.72%), a- Humulene (15.24%), Butanedioic acid (2.18%), ß-Selinene (3.81%), Naphthalene (1.90%), a-Selinene (6.10%),d-Cadinene (2.03%), Nerolidol (2.64%), trans-Nerolidol (1.32%), Cycloheptane (0.13%),Spathulenol (1.98%), Caryophyllene oxide

(2.14%), Viridiflorol (1.51%), 2-Naphthalenemethanol (0.66%), Trivertal (0.35%), Juniper camphor (1.57%), Cubenol (0.57%),ß-Cadina-1(6),4-diene (0.50%), Selina-6-en-4-ol (4.78%), Phytol (10.07%)[07].

The Murrayanol, murrayagetin, and marmesin-1"-O-rutinoside are bioactive chemicals found in the roots of Murraya koenigii. Additionally, the compounds mukoenine-A, B, and C, as well as murrastifoline-F.bis-2-hydroxy-3-methyl carbazole, bismahanine, bi koeniquinone-A, and bismurrayaquinone-A were also discovered. extracted from the bark.

The benzene extract of roots consist of mukoline, mukolidine. Additionally discovered in the root were girinimbine and koenoline, a synonym for 1-methoxy-3-hydroxy methyl. carbazole[08]. Mahanimbine and koenimbine can be extracted from the Murrayakoenigii's fruit using petroleum ether. Furthermore, Along with mahanimbine, murrayazolidine, girinimbine, koenimbine, isomahanine, and murrayanol, mahanine.[09,10] Koenimbine, koenine, and kurryam are the three biologically active carbazole alkaloids found in Murraya koenigii seeds. Additionally, mahanimbine, girinimbine, koenimbine, mahanine, and isomahanine are present in the seed.

The seeds of Murraya koenigii included minor furocoumarins like xanthotoxin, indicolactone, anisoalctone, and 2,3-epoxyindicolactone, which is a furocoumarin lactone. This would be the first furocoumarin with a monoterpenoid lactone chain identified in the Murraya genus. isobyaknagelicol, byakangelicol and isogosferol. isoheraclenin, isoimperatonin, oxypeucedanin, isopimpinellin and bergaptan also discovered in the seeds of Murrayakoenigii[06,07]. Leaf Koenimbine, O-methyl murrayamine, O-methyl mahanine, isomahanine, bismahanine, and bispyrayafoline are the main components of Murrayakoenigii. Other components include koenigine, koenine, koenidine, mahanimbine, isomahanimbine, koenimbidine, and koenine. murrayacine, isomahanimbicine, Euchrestine B, bismurrayafoline E, mahanimbicine, Mahanine, bicyclomahanimbicine, cyclomahanimbine, mahanimbidine, mukonicine, and 8,8"-bis koenigine, which are all monomers of the drug koenigine.

The dried leave consist of glycozoline, 1-formyl-3 methoxy-6-methyl carbazole and 6, 7- dimethoxy-1- hydroxy-3 methyl carbazole. Additionally, Murraya koenigii leaves contain minerals, fibre, carotene, vitamin C, and protein, Nicotinicacid[09,10]. The chemicals that were extracted from the bark of Malayan Murraya koenigii using hexane, dichloromethane, and the chemical structure below (Figure 2) is shown. isolated via various chromatographic techniques and the structural characterization of the isolated compounds were supported by spectroscopic methods including Nuclear Magnetic Resonance, Infrared, Ultraviolet, Mass spectra data[11].

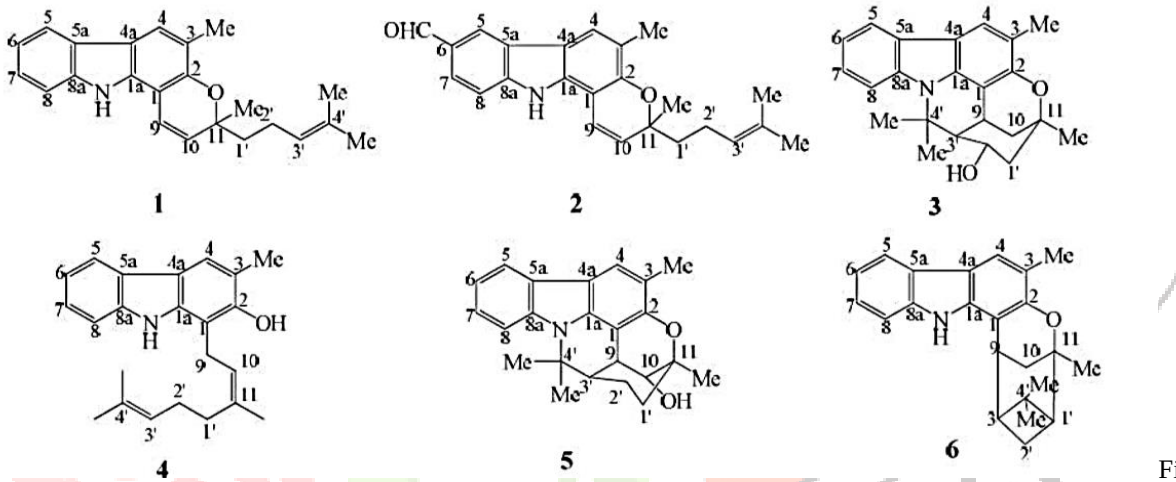

Figure. Shows the chemical structure isolated from the bark of Murraya koenigii

III. PHARMACOLOGICAL ACTIVITY OF MURRAYA KOENIGII ANTIMICROBIAL ACTIVITY

Salmonella, Staphylococcus aureus, Escherichia coli, Bacillus subtilis typhi, and the fungi Aspergillus niger, Candida albicans, and Trichophyton rubrum were tested against the root of Murraya koenigii extract in hexane, methanol, and chloroform.

The root of the hexane, methanol, and chloroform extract ofMurraya koenigii was effective against all of the tested bacteria, and the methanol extract had the strongest antimicrobial consequences for Staphylococcus aureus and Trichophyton rubrum. Three of the four aforementioned extracts were efficient against Staphylococcus aureus, and the aqueous root extract was also determined to be ineffective[12].

ANTIPYRETIC ACTIVITY

The ethanol Murraya koenigii leaf extract exhibits an antipyretic effect compared to petroleum ether extract and chloroform extract, with paracetamol dose of 150mg/kg as a standard drug[13]. The rats were fevered by parenterally administering 10mg/kg of brewer's yeast.

HYPOGLYCEMIC EFFECTS

The alloxon-induced Rats were administered an aqueous and a methanolic extract of Murrayakoenigiileaves, and it was discovered that the plasma glucose levels decreased[14].

The blood sugar, total cholesterol, triglyceride, and body fat levels are all significantly reduced by ethanolic Murraya koenigii extract stem. weight[15]. Mahanimbine, a carbazole alkaloid found in Murraya koenigii leaves, been demonstrated to have hypolipidemic and antihyperglycemic effects when administered intraperitoneally at doses of 50 and 100 mg/kg once a week for 30 days to adult male Wistar rats that had been streptozotocin-induced hyperglycemia and nonhyperglycemic shock in diabetic rats. There was a noticeable decrease in triglycerides, low density lipoprotein and very

low density lipoprotein during the course of the treatment's first 30 days. Following treatment, it was discovered that levels of total cholesterol, triglycerides, low density lipoprotein, and very low density lipoprotein had significantly decreased, while levels of high

density lipoprotein had significantly increased. Mahanimbine also exhibits strong alpha glucosidase inhibitory effects and pronounced alpha amylase inhibitory effects.compared to the artificial substance acarbose[16].

HEPATOPROTECTIVE ACTIVITY

When carbon tetrachloride was administered to adult rats, at dosages of 200 mg of Murraya koenigii leaves methanolic extract mg/kg, 300 mg/kg, and 500 mg/kg showed a reduction in the elevation on hepatic marker enzymes (Aspartate transaminase, Alanine transaminase, Serum bilirubin, and Alkaline phosphate).Spraggawley rats. The maximum dose of 500mg/kg was comparable to Silymarin, a common medication that has been used in clinical settings to treat liver disease[17].

The hepatoprotective Murraya koenigii's effectiveness aqueous extract in ethanol-induced adult wistar rats was assessed at doses of 1g/kg and 2g/kg. A potential hepatoprotective effect against ethanol-induced hepatitis was seen at 1g/kg of the extract. The aqueous extract improves cellular stability by reducing cellular necrosis and reduces lipid peroxidation activity.

Additionally, both extract dosesserum transaminase for glutamate pyruvate (SGPT) and alkaline phosphatase levels were discovered to show a comparable declineALKP (ALKP) was less effective than the positive control, L-ornithine-L-aspartate (LOLA). Beyond that, Following administration of the extract in both doses, the serum bilirubin level does not significantly decrease[18].

ANTI INFLAMMATORY

Leaves of Murraya koenigii were extracted using three different solvents: petroleum ether, chloroform, ethanol, too. a 250 mg dosage mg/kg was chosen, which is 1/10,000 of the LD50 value of 2500 mg/kg. The dose was administered orally. It was discovered that in contrast to the three solventsThe ethanolic extract significantly reduces the paw edema caused by carrageenan in Albino rats of the wistar strain[19].

Additionally, it was discovered that Murraya koenigii leaf extract in methanol and aqueous form, 400 mg/kg, is more efficient than extracts of petroleum ether and hexane at preventing carrageenan-induced edema in male albino rats. When compared to other extracts, methanol was determined to have the strongest anti-inflammatory effects. It was discovered that, when compared to the other two solvents, ethanolic extract significantly lessens the paw edema that carrageenan causes in Albino rats of the wistar strain[16].

Additionally, it was discovered that Murraya koenigii leaf extract in methanol and aqueous form, 400 mg/kg, is more efficient than Hexane and petroleum ether extracts at preventing carrageenan-induced edema in male albino rats. When compared to aqueous extract, the methanol extract was determined to have the highest anti-inflammatory activity[20].

CYTOTOXIC ACTIVITY

In A549 cells, the carbazole alkaloid girinimbine, which is obtained from Murraya koenigii's root, induces cell death by apoptosis in a dose-dependent manner. Additionally, the author suggests that the release of cytochrome C and traditional mitochondrial pathway may be used for the cell death caused by girinimbine. Apoptosis that depends on caspases[19]. Additionally, it was discovered that the carbazole alkaloids from the stems had an impact on the proliferation a human leukaemia cell line HL-6024 and that Koenoline from the bark of the root anticancer efficacy against KB cell culture. [21]

ANTI OBESE ACTIVITY

In a study conducted by the author, it was discovered that Murraya koenigii leaf ethanolic extract, administered orally to male wistar rats for 30 days, was helpful in lowering body weight, cholesterol, triglycerides, and glycemic levels[22]

CHEMOPROTECTIVE ACTIVITY

The chromosomal damage caused by cyclophosphomide at the level of 50 mg/kg was significantly reduced and the bone density was increased among Swiss albino mice after receiving a single dose of 100 mg/kg Murraya koenigii methanolic extract leaves. marrow defense[23].

ANTIHELMINTIC EFFECTS

The Murraya koenigii leaf extracts in ethanol and water have antihelmintic activity against Pheretima posthuma, and both extracts are comparable to the commonly used medication Piperazine.

It is thought that the polyphenolic component tannins discovered in the Murraya koenigii leaves exhibit antihelminth properties. Additionally, tannins have the potential to function similarly to synthetic phenolic antihelmints like bithionol, oxyclozanide, and niclosamide by interfering with energy production by uncoupling oxidative phosphorylation, binding to free proteins in the host's gastrointestinal tract, or binding to glycoproteins on the parasite's cuticle and having lethal effects on it[24].

The Indian earthworm (Pheretima posthuma) is susceptible to the anthelminthic effects of Murraya koenigii's methanolic extract in a dose-dependent manner. The Indian earth worm is paralyzed by the methanolic extract after 18 minutes, and the fatal effect is promoted after 45 minutes[25].

INOTROPIC ACTIVITY

Heart of the frog by itself responds favorably to the Murraya koenigii's ethanolic extract fresh leaves in a dose-dependent manner. According to one theory, the Murrayakoenigii boost the calcium availability from extracellular locations, which results in the positive inotropic activity[26].

NEPHROPROTECTIVE

In streptozotocin-induced diabetic male rats, oral treatment of an aqueous extract the leaves of Murraya koenigii a daily basis for 30 days, was reported to significantly lower serum levels of urea and creatinine and to stimulate renal tissue regeneration[27].

MOSQUITOCIDAL ACTIVITY

At concentrations ranging from 250ppm to 900ppm [28], Murraya koenigii leaf extracts in petroleum ether and acetone work as a larvacide against Aedes aegypti

IV. CONCLUSION

One of the medicinal plants that our ancestors employed many centuries ago was Murraya koenigii. Most homes in the modern era of globalisation lack a curry plant, and many diets have been modified as a result. dependent to synthetic agent as taste enhancer against curry leaves. Thus, the importance of these beneficial plant should be emphasized and the bioactive components of Murraya koenigii should be analyzed further and used against the disease that have been developed resistance and synergistic studies should be carried out.

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