

REVIEW ARTICLE REVIEW ON PHYTOCHEMICAL, PHARMACOLOGICAL ACTIVITY OF MURRAYA KOENIGII

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ABSTRACT

Objective: The aim of this review study is to update information about Traditional uses, Phytochemical, and pharmacological studies of *Murraya koenigii*. Literature of *Murraya koenigii* was collected and reviewed.

Results: *Murraya koenigii* is having broad types of characteristics such as antimicrobial activity, Anti-inflammatory, Antipyretic activity, Hepatoprotective activity, Hypoglycemic effects, Cytotoxic activity, Antihelmintic effects, Nephroprotective, antibacterial activity, antifungal activity, antiprotozoal activity. The medicinal utilities have been described especially for leaf, stem, and bark. The present review incorporates the description of *Murraya koenigii*, its phytochemical constituents and various pharmacological activities of isolated compounds as well as bioactivity of extract studies carried out.

Keywords: *Murraya Koenigii*, Phytochemistry, Pharmacological Activities, Review.

I. INTRODUCTION

The history of curry leaves are seen in early 1st to 4th century AD. In Tamil and Kannada literature it was updated as word 'Kari' with its uses. The word now popularly used for the *Murraya koenigii* is curry leaf which is originated from Tamil word Kari which means as 'spiced sauce. the early literatures of Tamil and Kannada the use of *Murraya koenigii* is described as the flavoring agent for the vegetables. Today *Murraya koenigii* are grown as the cultivated crop in India, Sri Lanka, Southeast Asia, Australia, Pacific Islands and Africa as flavoring agent for the food.

Murraya koenigii belongs to the family of Rutaceae. is called as Surabhinimba in Sanskrit and in Hindi we called as Kurrypatte. *Murraya koenigii* represents more than 150 genera and 1600 species. The leaves of this plant have been used widely in Indian culinary and the chemical substance which responsible for its aromatic characteristic is P- gunrunner, P- caryophyllene, P- elemene and O- phellandrene. The presence of β - pinene, β - caryophyllene, β - phellandrene and α - pinene has ability to control the food spoilage either alone or by combination. The author states that the three different morphotypes of *Murraya koenigii* poses different intensity in its flavor.

The barks and roots are used externally to cure the bites of the poisonous animals; the green leaves were eaten raw as a cure for dysentery, diarrhea. Infusion of roasted leaves were given in order to stop emesis. Furthermore, *Murraya koenigii* were also used as blood purifier, tonic and cure for stomachache and used as flavoring agents in curries and chutneys. Curry leaves were also used as calcium source to those having calcium deficiency besides that it also consists Vitamin A, Vitamin B and B2, Vitamin C and iron. For the treatment of morning sickness; fresh juice of curry leaves together with lime juice and sugar is given and it is also applicable for vomiting due to indigestion. In the case of stomach upsets, the curry leaves are grounded to a fine paste and mixed with buttermilk and consumed orally. A paste of curry leaves is applied on the boils for swift relief; besides that, renal pain can be cured by consuming the root as a juice. The fresh juice of curry leaves can prevent the progression of cataract. *Murraya koenigii* will retain the black color of the hair or in other words, it will prevent the premature greying of the hair.

SYNONYM

Kurry Patta (Hindi); Curry Leaf (English), Mahanimb (Sanskrit); Karivempu (Tamilnadu). Mitha Neem (Himachal Pradesh); Karepaku (Andhra Pradesh), Narasingha (Assam); Barsanga, Kartaphulli (Bengal); Gorenimb (Gujrat); Kathnim, Mitha Neem, Karibeve (Karnataka); Kariveppilei (Kerala); Gandhela, Gandla, Gani (Kumaon); Bhursanga (Orissa);

TAXONOMICAL CLASSIFICATION

Kingdom – Plantae

Sub-kingdom – Tracheobionta
Superdivision - Spermatophyta
Division - Magnoliophyta
Class - Magnoliopsida
Subclass - Rosidae
Order - Sapindales
Family - Rutaceae
Genus - *Murraya* J. Koenig ex L
Species - *Murraya koenigii* Spreng.

DISTRIBUTION

Murraya koenigii is distributed and cultivated throughout India. It is found from Sikkim to Garhwal, Bengal, Assam, Western Ghats, and Travancore-Cochin. The seeds germinate without restraint under shade or partial shade. This curry leaves can be found in moist forest of 500-1600 meters" in height especially in Guangdong, S Hainan, S Yunnan. Bhutan, Laos, Sri Lanka, Thailand, Nepal, Vietnam. Upon with the South India immigrants the curry leaves arrive to Malaysia, South Africa, and Reunion Island.



Fig: Plant of *Murraya koenigii*

MORPHOLOGICAL CHARACTERISTICS

Murraya Koenigii has small spreading shrub which about 2.5 meters in height, the stem is dark green to brownish in color. Upon peeling of the bark longitudinally the underneath white wood is visible. The main stems diameter is about 16cm. The leaves are about 30 cm long with each bearing 24 leaflets and have a reticulate venation. The flower is white funnel- shaped, having a sweet aromatic characteristic and the average diameter of fully opened flower would be 1.12cm and it is bisexual. The fruits are round to oblong in shape with 1.4 to 1.6cm in length and 1 to 1.2cm in the diameter. The fruit upon fully ripe will be black in color together with a shining surface and the pulp will be in wisteria blue. The seed will be spinach green with 11mm long and weigh about 445mg.

TRADITIONAL USES

Fresh leaves, dried leaf powder, and essential oil are widely used for flavouring soups, curries, fish and meat dishes, eggs dishes, traditional curry powder blends, seasoning and ready to use other food preparations. The essential oil is also utilized by soap and cosmetic aromatherapy industry. Curry leaves are boiled with coconut oil till they are reduced to blanked residue which is then used as an excellent hair tonic for retaining natural hair tone and stimulating hair growth. It is traditionally used as a whole or in parts as antiemetics, antidiarrheal, febrifuge, blood purifier, antifungal, depressant, anti-inflammatory, body aches, for kidney pain and vomiting.

PHYTOCHEMISTRY

The matured curry leaves consist of moisture, protein which is of about 1.15% of nitrogen, carbohydrate 14.6% which is of total sugars and total ash 13.06%. The bioactive components in curry leaves are oxalic acid, resin, carbazole alkaloids and the major bioactive compounds such as the koenigin, murrayastine, coumarine, bicyclomahanimbicine, cyclomahanimbine, koenidine and pypayafolinecarbazole. The composition of volatile compounds found in the essential oil of *Murraya Koenigii* 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%), β -Terpinol (2.52%), trans-Piperitol (0.40%), Chrysanthenyl acetate (0.39%), Lavandulyl acetate (1.67%), Bornyl acetate (1.68%), α -Copaene (0.82%), β - Elemene (0.35%), (Z)-Jasmone (0.11%), β -Caryophyllene (19.50%), Aromadendrene (0.72%), α - Humulene (15.24%), Butanedioic acid (2.18%), β -Selinene (3.81%), Naphthalene (1.90%), α -Selinene (6.10%), δ -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%), β -Cadina-1(6),4-diene (0.50%), Selina-6-en-4-ol (4.78%), Phytol (10.07%).

The roots of *Murraya koenigii* consist of murrayone, muriatic, marmesin-1"-O-rutinoside. In addition to that three monomeric and five binary carbazole alkaloids namely mukoenine-A, B and C and murrastifoline-F.bis-2-hydroxy-3-methyl carbazole, bismahanine, bi koeniquinone-A and bismurrayaquinone-A were also extracted from the bark. The benzene extract of roots consists of mukoline, mukolidine. The root were also found to have girinimbine and the root bark consist of koenoline which synonym to 1-methoxy-3-hydroxy methyl carbazole.

The fruit of the *Murraya koenigii* consist of mahanimbine and koenimbine upon extracted by petroleum ether. Furthermore, murrayanol and were isomahanine isolated together with mahanimbine, murrayazolidine, girinimbine, koenimbine and mahanine.

Leaf of *Murraya koenigii* consist of koenimbine, O-methyl murrayamine, O- methyl mahanine, isomahanine, bismahanine and bispyrayafoline, koenigine, koenine, koenidine, mahanimbine, isomahanimbine,koenimbidine and murrayacine, isomahanimbicine, Euchrestine B, bismurrayafoline E, mahanimbicine, bicyclomahanimbicine, cyclomahanimbine, bicyclomahanimbine, mahanimbidine, mukonicine, 8,8"-bis koenigine which consist monomer of koenigine and minor alkaloid; mahanine. The dried leave consists of glycozoline, 1-formyl-3 methoxy-6-methyl carbazole and 6, 7- dimethoxy-1- hydroxy-3 methyl carbazole. The leaves of *Murraya koenigii* also consist of protein, carbohydrates, fibre, minerals, carotene, vitamin C, Nicotinicacid.

Seed of *Murraya koenigii* consist of 3 bioactivecarbazole alkaloids which is kurryam, koenimbine and koenine. Furthermore, the seed also contain mahanimbine, girinimbine, koenimbine, mahanine and isomahanine. An indicolactone, anisoalctone and 2",3"epoxyindicolactone which is a furocoumarin lactone were extracted from the seeds and this would be the first furocoumarin with a mono terpenoid lactone chain found in the genus of the *Murraya* and minor furocoumarins were also found in the seeds of *Murraya koenigii* such as xanthotoxin, isobyaknagelicol, byakangelicol and isogosferol. isoheraclenin, isoimperatonin, oxypeucedanin, isopimpinellin and bergaptan were also found in the seeds of *Murraya koenigii*.

PHARMACOLOGICAL ACTIVITY

Antimicrobial activity

The hexane, methanol, and chloroform extract of the *Murraya koenigii* root were tested against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Salmonella typhi* and fungal strain of *Aspergillus niger*, *Candida albicans* and *Trichophyton rubrum*. The hexane, methanol, and chloroform extract of the root of *Murraya koenigii* was effective on all the tested strains and methanol extract showed more significant antimicrobial activity compared to the others with maximum inhibitory effect on *Staphylococcus aureus* and *Trichophyton rubrum*. The *Staphylococcus aureus* were susceptible to the all the three extracts above, furthermore the aqueous extract of the root was found to be ineffective against the tested microorganism.

Anti-inflammatory

The leaves of *Murraya koenigii* was subjected to extraction with three various solvents; petroleum ether, chloroform, and ethanol. A dose of 250mg/kg was selected which is a 1/10th of 2500mg/kg which was considered as LD₅₀, the dose was administrated via oral route. Compared to the three solvents, it was found that ethanolic extract shows significant reduction in carrageenan induced paw edema in the Albino rats of the wistarstrain.

Furthermore, it was found that the methanol and aqueous the extract of *Murraya koenigii* leaves is effective against carrageenan- induced edema in male albino rats at the dose of 400mg/kg, compared to petroleum ether and hexane extracts which has no decrease in the inflammation. The methanol extract was found to have an utmost anti-inflammatory activity compared to aqueous extract.

Antipyretic activity

The rats were febrile with the parenteral administration of 10mg/kg of brewer's yeast and were found that the ethanol extract of *Murraya koenigii* leaves poses an antipyretic activity compared to petroleum ether extract and chloroform extract, with paracetamol dose of 150mg/kg as a standard drug.

Hepatoprotective activity

The methanolic extract of *Murraya koenigii* leaves at the doses of 200mg/kg, 300mg/kg and 500mg/kg has shown decrease in the elevation on hepatic marker enzymes (Aspartate transaminase, Alanine transaminase, Serum bilirubin and Alkaline phosphate) as a result of administration of carbon tetrachloride on adult Sprague Dawley rats. The maximal dose of 500mg/kg was comparable to the standard drug, Silymarin, which has been used clinically for the treatment of the liver disease.

Aqueous extract of *Murraya koenigii* the dose of 1g/kg and 2g/kg were used to evaluate the hepatoprotective activity on ethanol induced adult wistar rats. 1g/kg of the extract were found promising hepatoprotective activity against ethanol induced hepatitis. The aqueous extract inhibits the lipid per oxidation.

Hypoglycemic effects

The plasma glucose levels were found to be decrease in the alloxan induced rats on treatment with aqueous and methanolic extract of *Murraya koenigii* leaves. The ethanolic extract of *Murraya koenigii* stem shows remarkable reduction in the blood glucose level, total cholesterol level, triglyceride, and body weight. Mahanimbine which is a carbazole alkaloid obtained from *Murraya koenigii* leaves shows antihyperglycemic and hypolipidemic activity, in which intra-peritoneal administration of 50mg/kg and 100mg/kg for once a week for 30 days has shown anti-hyperglycemic effects and hypolipidemic effects on streptozotocin induced adult male wistar rats with non-hypoglycaemic shock in diabetic rats. In the 30 days of the treatment, it was found a significant reduction in the total cholesterol level, triglycerides, low density lipoprotein and very low-density lipoprotein and increased in high density lipoprotein levels. Furthermore, mahanimbine shows a marked alpha amylase inhibitory effects and weak alpha glucosidase inhibitory effects compared with the synthetic drug, acarbose. activity and enhances the cellular stability by inhibiting cellular necrosis. Furthermore, both extract doses were found to exhibit a comparable decrease in serum glutamate pyruvate transaminase (SGPT) and alkaline phosphatase (ALKP) less than L-ornithine- L- aspartate (LOLA) which serve as positive control. Besides that, the serum bilirubin has no major reduction in its level upon administration of both doses of the extract.

Cytotoxic activity

Girinimbine, a carbazole alkaloid which is extracted from the root of *Murraya koenigii* exhibit cell death via apoptosis in a dose dependent manner in A549 cells. Furthermore, the author suggest that the cell death induced by the girinimbine can be via classical mitochondrial pathway with cytochrome C release and caspase dependent apoptosis. In addition to that, Koenoine from the root bark were found to have an anticancer activity against KB cell culture and the carbazole alkaloids from the stems has effects in the growth on human leukemia cell line HL-60.

Anti-obese activity

In research done by the author, it was found that the ethanolic extract of *Murraya koenigii* leaves which were administrated orally to male wistar rats for 30 days, were effective in the reduction of body weight, cholesterol, triglyceride and as well as controlling the glyceic levels.

Antihelmintic effects

The leaves of *Murraya koenigii* poses as antihelmintic effects, by which the ethanolic and aqueous extract of the leaves shows an Antihelmintic effects against *Pheretima posthuma* and the both extract was comparable to the standard drug Piperazine. It is believed that tannins which are the polyphenolic compound found in *Murraya koenigii* leaves shows antihelmintic effects. Furthermore tannins can act similar like the synthetic phenolic antihelmintic such as the bithionol, oxiclozanide and niclosamide by interrupting the energy generation by uncoupling oxidative phosphorylation or by binding of the tannins to the free protein in the gastrointestinal tract of the host or binding to the glycoprotein on the cuticle of the parasite and causes the lethal effects on it. The methanolic extract of *Murraya koenigii* shows antihelmintic effects against the Indian earthworm (*Pheretima posthuma*) in a dose dependent manner. The methanolic extract causes the

paralysis of Indian earth worm at 18 minutes and promotes lethal effect at 45 minutes.

Chemoprotective activity

A single dose of 100mg/kg of methanolic extract of *Murraya koenigii* leaves which is administered before cyclophosphamide at the dose of 50mg/kg via intraperitoneal administration on Swiss albino mice has shown a significant reduction in the cyclophosphamide induced chromosomal damage and enhance the bone marrow protection.

Inotropic activity

The ethanolic extract of the fresh leaves of *Murraya koenigii* shows a positive inotropic effect on the isolated frog heart in a dose dependent manner. It was suggested that the positive inotropic activity is achieved by an increase in the availability of calcium from the extracellular sites by the *Murraya koenigii*,

Nephroprotective

Oral administration of aqueous extract of *Murraya koenigii* leaves in a daily manner for 30 days in streptozotocin induced diabetic in male rats were found significant reduction in serum urea and creatinine levels and promote tissue regeneration in kidney.

Antifungal activity

The essential oil from leaves of *Murraya koenigii* showed antifungal activity against *C. albicans*, *C. tropicalis*, *A. niger*, *A. fumigates*, *Microsporum gypseum* and *Murraya koenigii* was effective against *C. albicans* even at a dilution of 1:500. The ethanolic extract of the leaves showed fungitoxicity against *Colletotrichum falcated* and *Rhizoctonia solani*³⁵. The ethanolic extract of the roots and the whole plant excluding roots of *Murraya koenigii*, however, did not show any antifungal activity against *Cryptococcus neoformans*, *Trichophyton mentagrophytes* and *Microsporum Canis*.

Antiprotozoal activity

Ethanolic extracts (55 %) of *Murraya koenigii* whole plant excluding roots (extract A) and roots alone (extract B) were screened for their pharmacological actions. Extract A showed antiprotozoal action against *Ent. Histolytica*, antispasmodic effect on isolated guinea pig ileum, whereas extract B showed antiprotozoal activity against *Ent. Histolytica* and as well as antihypertensive activity in cat/dog.

II. CONCLUSION

Murraya koenigii was one of the medically beneficial plants which has been used many centuries ago by our ancestors. Thus, the importance of these beneficial plant should be emphasized and the bioactive components of *Murraya koenigii* should be analyzed. The various pharmacological activities of the plant has been seen such as activity on antimicrobial activity, anti-bacterial, antifungal, cytotoxic activity, anti-inflammatory, hepatoprotective, anthelmintic, chemoprotective and hypoglycaemic effect with many other phagocytic activities. The chemical composition of the *Murraya koenigii* consists of essential oil alkaloids and terpenoid. Thus, Curry leaves merits further phytochemical, pharmacological and clinical investigations for development of an effective natural plant.

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