

## ***Murrayakoenigii*Spreng.- A plant with blessings**

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### **Abstract**

Medicinal plants are the nature's gift for human beings. From ancient time plants have been utilized by humans for food as well as for healthcare though there are well developed technologies and synthetic drugs, the use of medicinal plants always remain at the top due to their safety, easy availability and low cost. *Murrayakoenigii*Spreng., belongs to family Rutaceae, is one of the "Magical Plant of Indian spice" which has served not only as food enhancer but also as village or folk medication to cure many disorders. The tribal communities have reported to use many parts of the *Murrayakoenigi*to cure various ailments. A number of chemicals present inside the plant interact to elicit their pharmacodynamic response. The plant is highly valuable with various pharmacological activity and some of which have been scientifically proved. The compound carbazol alkaloids are responsible for substantial medicinal activities.

Keywords- *Murrayakoenigii*Spreng., Pharmacodynamic responses, nature's gift

### **Introduction**

Since ancient times, plants are been utilized by humans for various purposes. The ability of plants to overcome various ailments has led human beings to use them as medicinal plants. In present era medicinal plants have become an enormous part in supporting healthcare system of world. According to a bulletin of World Health Organization (WHO, 2001) 80% the population in developing countries still rely upon medicinal plants for their primary healthcare needs (AK Shakya, 2016; AKMurugan. *et. al.*, 2017). Among the mega biodiversity countries of the World, India possesses a historical track record of having made asignificant global contribution due to the traditionalknowledge of the medicinal plants (AKMurugan. *et. al.*, 2017). Medicinal properties of plants does not restrict to a specific part; any part of the plant such as root, stem, bark, flower, leaves or whole plant etc. that can be used to cure diseases. They also form the essential raw

materials for the production of traditional remedies of Ayurveda, Siddha, Unani, Homeopathy, Tibetan and other systems of medicine including the folk, ethno or tribal medicines basis to be used as crude drugs.

The family Rutaceae represents more than 150 genera and 1600 species, one of which is *Murrayakoenigii* Spreng. (MNishan and P Subramanian, 2015; J Molly *et. al.*, 2017). It has different names. (MNishan and P Subramanian, 2015):

Sanskrit: Surabhinimba

Tamil: Karivempu

Bengali: Barsunga

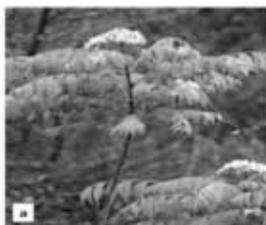
Hindi: Kurrypatte

Globally there are about 14 species belong to genus *Murraya*, of which *Murrayakoenigii* Spreng and *Murrayapaniculata* (Linn) Jack are found in India (PMitra *et. al.*, 2017; MNishan and P Subramanian, 2015). The members of this genus are valued for their aroma and medicinal value as it contains a number of chemical constituents that interact to elicit their "Pharmacodynamic responses" (J Molly *et. al.*, 2017).

**Distribution:** *Murrayakoenigii* Spreng. is a plant native of South East Asia and Australia. It is found growing wild and is cultivated in most of the parts of India, up to the height of 1500 to 1655 m from the sea level. It can be found abundantly along the outer Himalayas, Assam, Chittagong, Upper and Lower Burma, Andaman Islands, Maharashtra, Tamil Nadu, Andhra Pradesh and in the forests of Western Ghats in Karnataka (G Singh *et. al.*, 2016).

**Ecology And Cultivation:** *Murrayakoenigii* Spreng. is found in Tropical and Sub-tropical climatic zones in sunny to semi-shaded locations. The plant is very frost sensitive and it requires well drained soil which is enriched with lots of organic material (KK Chandrul and B Singh, 2016).

**Propagation:** Propagation of plant can be done by mounting the small suckers from the bases, by root/shoot cutting, or simply by seed propagation (S Mandal, 2016; KK Chandrul and B Singh, 2016).



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Retrieved on 19 January 2017



<http://www.scribd.com/document/316077316/073>  
Retrieved on 19 January 2017



<http://www.scribd.com/document/316077316/073>  
Retrieved on 4 March 2017



[https://upload.wikimedia.org/wikipedia/commons/8/8d/403CorryLeaf\\_Fruits.jpg](https://upload.wikimedia.org/wikipedia/commons/8/8d/403CorryLeaf_Fruits.jpg)  
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#### Morphological Characteristic

#### **Fig.1 Shows the whole plant of *Murrayakoenigii*(a) leaves (b) flower (c) and fruits (d)**

- a) Stem: More or less deciduous shrub or small tree, growing 6m tall, with slender but strong woody stem having 14-42 cm diameter and covered with dark grey bark. The stem is dark green to brownish in color, with numerous dots on it (KK Chandrulan B Singh, 2016; S Mandal, 2016; MMHossain *et. al.*, 2016). It exposes white wood underneath upon peeling of the bark longitudinally (SC Saini and GBS Reddy, 2015). The diameter of main stem is 16cm (KK Chandrul and B Singh, 2016).
- b) Leaves: The leaves are bipinnately compound, 30 cm long, each bearing 24 leaflets alternate on rachis with reticulate venation. The leaflets are 4.9cm long, 1.8cm broad, ovate to lanceolate, short stalked, with dotted gland and having 0.5cm long petiole (KK Chandrulan B Singh, 2016).
- c) Flower: From the mid-April plant starts flowering and ends in the middle of May. However, the peak flowering season has been observed in the last week of April (S Mandal, 2016). Inflorescence bears 60-90 flowers. The flowers are small, bisexual, white, funnel-shaped, sweetly scented, stalked, pentamerous, hypogynous, actinomorphic, ebracteate with average diameter of fully opened flower being 1.12 cm. The calyx is deeply lobed with five cleft, pubescent, persistent, inferior and green in color. Petals are five with free, whitish, inferior, lanceolate, length 5mm, glabrous with dotted glands. Androecium is polyandrous, inferior, with 10 stamens, arranged into circles of five each; smaller stamens are 4 mm long whereas the longer ones are 5 to 6 mm. Gynoecium 5 to 6 mm long stigma, bright, sticky; style, short; ovary, superior white small flower (KK Chandrul and B Singh, 2016; SC Saini and GBS Reddy, 2015).

- d) Fruit: Fruits occur in close clusters. They are small ovoid to sub-globose, glandular, with thin pericarp enclosing one or two seeds which are spinach green in color (SC Saini and GBS Reddy, 2015). Fruits are 1.4 to 1.6 cm long, 1 to 1.2 cm in diameter; fully ripe fruits, black with a very shining surface. Seed are 11 mm long and 8 mm in diameter (KK Chandrul and B Singh, 2016). The fruiting season has been observed in between the middle of July and the end of August. (S Mandal, 2016)

#### Uses

- a) Leaves: Curry leaves consist Vitamin A, Vitamin B and B<sub>2</sub>, Vitamin C and iron hence it is used as calcium source to those having calcium deficiency especially women suffering from osteoporosis. (MNishan and P Subramanian, 2015; KK Chandrul and B Singh, 2016; T Deepika and CM Noorjahan, 2016). People use the fresh leaves, dried leaf powder and essential oil for food industry. It can be eaten raw as a cure for dysentery and diarrhea. For stomach upsets, it is grounded to a fine paste and mixed with buttermilk and consumed orally and the infusion of roasted leaves is given to stop emesis. Fresh juice of its leaves along with lime juice and sugar is given for the treatment of morning sickness and for vomiting due to indigestion (T Deepika and CM Noorjahan, 2016; KK Chandrul and B Singh, 2016). Fresh juice is also reported to prevent the progression of cataract (KK Chandrul and B Singh, 2016). The leaves are effective against diabetes Mellitus and are applied externally to bruises, eruption and on the boils for swift relief. They are extensively used in treatment of mucus in the stool and influenza (N Kamat *et. al.*, 2015) as well as tonic (P Mitra *et. al.*, 2017). The blanked residue of boiled curry leaves along with coconut oil is used as natural hair toner and hair growth promoter and is known to retain the black color of the hair by preventing the premature graying of the hair. (H Dhongde *et. al.*, 2013; D Sharma *et. al.*, 2015; MNishan and P Subramanian, 2015). Leaves are used in fever, asthma and hypercholesteremia (CGalketiya *et. al.*, 2016). The Kurumba Communities (Thalamalai Hills, India) use the fried leaves by making *chatni* for good hair growth (R Deepakkumaret. *al.*, 2017). The incorporation of dried leaf powder in preparation of cookies increases the nutritional quality in dose dependent manner. (CR Drisya *et. al.*, 2015).
- b) Stem: The branches of *Murryakoenigi* are used to strengthen gums, popularly used to clean teeth as *datum* (PR Bhandari, 2012; AKumar *et. al.*, 2016).
- c) Fruits: Fruits are considered as astringent in Indo-China.
- d) Roots: The roots of the plant can be used for relieving pain of the kidney and removal of stains on teeth (KK Chandrul and B Singh, 2016; AKumar *et. al.*, 2016).
- e) Bark and roots: The barks and roots are used as stimulant by the physicians. They are used externally to cure the bites of the poisonous animals and eruptions (T Deepika and CM Noorjahan, 2016).
- f) Leaves and roots: The leaves and roots are bitter in taste analgesic, acrid, cooling, stomachic, carminative, stimulant, anti-diarrhoeal, anti-dysenteric, anti-emetic, antipyretic, used in

leucoderma, blood disorders (AKumaret. *al.*, 2016) and cure allays heat of the body, thirst and itching (SA James *et. al.*, 2016).

- g) Essential oil: The aromatherapy industry uses the essential oil in the making of soaps and cosmetics. (HDhongdeet. *al.*, 2013; D Sharmaet. *al.*, 2015). The plant is useful in the treatment and prevention of diabetes, cancer, and cardiovascular diseases. The leaves of the plant are highly rich in antioxidants, such as tocopherol,  $\beta$ - carotene and lutein, and possess anti-lipid peroxidative activities and providing protection against oxidative stress (SMandal, 2016).

#### Phytochemistry

The plants are rich source of carbohydrates, proteins, amino acids; alkaloids as well as vitamin A, vitamin B, minerals etc. (P Mitraet. *al.*, 2016) and leaves are rich in carotenoids,  $\beta$ -carotene, calcium and iron. (CRDrisyaet. *al.*, 2015). The dried leaf powder contains higher amount of  $\beta$ -carotene (8.8 mg %) and polyphenols (2100 mg %) than other leafy vegetables. (CRDrisyaet. *al.*, 2015). Numerous phytochemicals like koenigine, koenidine, koenine, mahanine, girinimbine, girinimbiol, koenimbine, O-methyl murrayamine A, O-methyl mahanine, bismahanine, bispyrayafoline, isomahanine, scopotin, murrayanine were also isolated from the leaves (P Mitaraet. *al.*, 2017).

The plant also contains a rich amount of carbazole compounds which is found in every part from plant including leaves, roots, bark and stem etc. and responsible for various pharmacological activities.

The alcoholic extract of stem bark has been reported to have some bioactive compounds, named as koenigine-quinone A, koeniginequinone B6, 9-carbethoxy-3-methylcarbazole, 9-formyl-3-methylcarbazole7, methyl-2-methoxycarbazole-3-carboxylate and 1-hydroxy-3-methylcarbazole while petroleum ether extract consists of Marmesin-1'-O- $\beta$ -D-galactopyranoside, osthol and umbelliferone10 and 3-(1,1-dimethylallyl) xanthyletin. Mukonal, a biogenetic intermediate of pyranocarbazole alkaloid was also detected in the stem bark of *Murrayakoenigii*. In addition to alkaloids, coumarin and cinnamic acid derivatives are found from the plant have also been previously isolated and characterized (MM Hossainet. *al.*, 2016). Four coumarin derivatives have been isolated from stem bark named as, Meranzin hydrate, Epoxyosthol, Isomeranzin and Murracarpin by MM Hossainet. *al.*, 2016. It also contains three cyclic monoterpenoidcarbazole alkaloids viz. murrayazolinol, murrayakoeninol, bicyclomahanimbine, affine, mahaminbineand girinimbine(K Ahmad, 2015; S Saiedet. *al.*, 2015)

The root bark contains monomeric and binary carbazole, quinone, mukoenine A, B and C, murrastifolin F, bis-2-hydroxy-3-methylcarbazole, bismahanine, biskoeniquinone A and bismurrayaquinone-A along with murrayanine, murrayastine, murrayatine, murrayacine and murrayazolinol(A Kumaret. *al.*, 2016).

The phytoconstituents P- gurjunene, P- caryophyllene, P- elemene and O- phellandrene are responsible for its characteristic aroma (PriyankaSangale and RupaliPatil, 2017) and the essential

oil also contains  $\alpha$ -pinene,  $\beta$ -phellandrene, (E) caryophyllene,  $\beta$ -selinene, tetradecanoic acid, hexadecanoic acid, c-eudesmol,  $\alpha$ -muurolol, (Z,E)-farnesol, and (Z,Z)-farnesol (NS Aniet. *al.*, 2016). It possesses the ability to control the food spoilage due the presence of compounds like  $\alpha$ -pinene,  $\beta$ -caryophyllene,  $\beta$ -phellandrene and  $\alpha$ -pinene either alone or in form of combination with other metabolites.

**Protein Profiling:** S. Satheskumar and N. Punniamurthy, 2017 investigated the effect of drying process on protein profile of its leaves by the standard SDS-PAGE procedure. Total 19 prominent bands were obtained, 14 (73.7%) with above 36kDa, in fresh curry leaves while in dried sample only 13 prominent bands were detected with an overall reduction of 31.6% of detectable proteins. The study, thus, revealed about the consumption of fresh herbs rather than dried and processed products for better results.

#### Pharmacodynamic Properties

**Hyperlipidemia effect:** Consumption of Curry leaf powder once daily for 45 consecutive days' decreases the serum transaminase. A pre and post-test also showed the significant reduction in creatinine and urea and showed no harmful effect on liver and kidney function. (J Molly *et. al.*, 2017).

**Antioxidant activity:** The methanolic extract of plant is reported to have a remarkable scavenging activity along with higher amount of total phenolic content. In reducing power assay, *Murrayakoenigii* showed best reducing power among all the experimented plants of Sri Lanka (CGalketiya *et. al.*, 2016). DDPH radical scavenging of methanolic extract was shown to be decreased as leaf > stem > fruit while in lipid peroxidation assay MDA level was reported to be higher in leaf extract compared to stem and fruit (P Vijayvergiya and R Vijayvergiya, 2016).

**Anti-cancer activity:** Girimbine, a carbazole alkaloids found in its roots is reported to inhibit cancer cell proliferation and promote apoptosis in human cancer cell lines by many researchers. The compound was found to inhibit angiogenesis both in vivo (zebrafish embryo model) and in vitro and subsequently induced apoptosis in a human colorectal adenocarcinoma cell line (HT-29) (V Imanet. *al.*, 2016).

**Anti-inflammatory activity:** Anti-inflammatory action was evidenced by the significant dose-dependent Girinimbine inhibition of nitric oxide production in lipopolysaccharide/interferon-gamma-induced cells along with significant inhibition of nuclear factor-kappa B translocation from the cytoplasm to nucleus in stimulated RAW 264.7 cells (V Imanet. *al.*, 2016). In mice, with carrageenan-induced peritonitis, oral pretreatment with girinimbine helped limit total leukocyte migration (mainly of neutrophils), and reduced pro-inflammatory cytokine levels (interleukin-1 beta and tumor necrosis factor-alpha) in the peritoneal fluid which had suggested that girinimbine could act as a chemopreventive and/or chemotherapeutic agent by inducing apoptosis while suppressing inflammation (V Imanet. *al.*, 2016).

Hydroalcoholic extract of its fruits when administered orally at dose 100mg/kg and 200mg/kg in male wistar albino rat, of which time dependently higher efficacy against carrageenan-

induced edema was reported at the dose of 200mg/kg compared to standard drug, indomethacin (GPitchaiah *et. al.*, 2016).

**Wound healing capacity:** It was found that topical application of *Murrayakoenigi* hydroalcoholic fruit extract ointment (90.3%) shows significant wound closure and epithelialization in less time compared to control (59.7%) (G Pitchaiah *et. al.*, 2016).

**Silver nano particle synthesis:** CKamaraj *et. al.*, 2017 synthesized silver nano particles (size: 5-100nm, spherical) using b-caryophyllene isolated from the leaf extract of *Murrayakoenigi*. It has been reported that AgNP exhibited promising activity on chloroquine-sensitive *Plasmodium falciparum* (3D7) ( $IC_{50}$ :  $2.34 \pm 0.07$   $\mu$ g/ml), as well as significant cytotoxic activity on lung cancer cells ( $IC_{50}$ :  $9.39 \pm 0.08$   $\mu$ g/ml) with reference to test agents: plant extract and purified b-caryophyllene. B-caryophyllene synthesized Ag NPs, thus, might be considered as a promising source for the development of cost effective and safer alternative drugs to treat malaria and cancer.

**Anti-thiamine activity:** Compounds with anti-thiamine property were isolated from its leaves by solvent extraction, acid hydrolysis, chromatographic experiments followed by crystallization. It has been reported that 1g of the compound inactivated 31.8 mg of thiamine hydrochloride in 1 h which proved the anti-thiamine activity of curry leaves. Even with seasonal variation showed maximum in vitro anti-thiamine activity in the compound isolated from its leaves during the period of July – August (P Mitra *et. al.*, 2017).

**Hepatoprotective activity:** An alkaloid fraction isolated from its ethanolic leaf extracts at the dose of 30 mg/kg and 100 mg/kg, p.o. has shown decrease in the serum levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT) and alkaline phosphatase (ALP) as a result of administration of carbon tetrachloride and paracetamol on adult wistar rats. The higher dose of *Murrayakoenigi* leaves (100 mg/kg, p.o.) was also reported to prevent the increase in liver weight compared to hepatotoxin treated animals. The cellular architecture of liver cells was also seen to be normal as compared to the standard drug silymarin, a well-known hepatoprotective agent. (PSangale and RPatil, 2017).

**Antimicrobial activity:** The methanol, water, acetone and hexane extract of *Murrayakoenigi* leaves were tested against *Methicillin Resistant Staphylococcus aureus*, *Micrococcus luteus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Candida albicans* and *Aspergillus Niger* and all the extracts were reported to have antimicrobial efficacy. (MV salomi and R Manimekalai, 2016).

The ethanolic extract with DMSO of *Murrayakoenigi* was shown to be more effective against two bacterial strains viz. *E. coli* and *P. aeruginosa* compared to fungal strains of *Candida albicans* and *Aspergillus niger*. The higher concentration (100 $\mu$ l) showed higher activity against bacterial strains as well as fungal strain compared to other concentration (25 $\mu$ l and 50 $\mu$ l) while for fungal strains both the concentration (25 $\mu$ l and 50 $\mu$ l) exhibited no effect (NS Kumar and N Simon, 2016).

The methanolic extract of roots and leaves were examined against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Trichophyton rubrum*, *Pseudomonas aeruginosa*, *Salmonella*

*typhi*, *Candida parapsilosis* and *Aspergillus niger*. Methanolic extract of both roots and leaves showed higher activity at very low concentration (2.5 µg/ml) against bacterial strain *Staphylococcus aureus* than *E. coli*, *Bacillus subtilis* and fungal strain *Candida parapsilosis* than *Aspergillus niger* (NBRao, et. al., 2015).

**Anti-bacterial activity:** The antibacterial activity of the ethanolic leaf extract of *Murrayakoenigii*, *T. occidentalis* and their synergy was tested at the concentration of 500mg/ml, 250mg/ml, 125mg/ml, 62.5mg/ml and 31.25mg/ml. The higher concentration (500mg/ml) of ethanolic extract of *Murrayakoenigii* was more effective against all the tested strains with *K. pneumonia* as a most susceptible and *S. dysenteriae* as a least susceptible strain. It was further reported that the synergy of *Murrayakoenigii* and *T. occidentalis* gave higher zone of inhibition compare to individual extract of *Murrayakoenigii* and *T. occidentalis* at the same concentration (FI Akinnibosun and JA Umufu, 2015).

**Anti-listerial activity:** A combination of pediocin (a natural antimicrobial) and *Murrayakoenigii* berries substantially reduced *Listeria innocua* count which was artificially inoculated in the raw goat meat emulsion at 4°C storage as compared to control and sodium nitrite and BT2 (Y Kumaret. al., 2017). Hence, this was suggested that a natural antioxidant and antimicrobial could be used to maintain the oxidative and microbial quality of minimally processed raw meat products at refrigerated temperature.

**Antinociceptive effects:** Methanolic extract of *Murrayakoenigii* was evaluated for its antinociceptive potential by two methods, formalin-induced licking and acetic acid-induced writhing tests at the doses of 50, 100, and 200mg/kg. In both the test significant inhibition was observed in dose dependent manner. Furthermore, inhibition of glutamate induced pain was also reported and pretreatment with glibenclamide (an ATP-sensitive potassium channel blocker) at 10mg/kg significantly reversed the plant-mediated antinociception which suggest the possible antinociceptive mechanism including glutamatergic system and the ATP-sensitive potassium channels (NS Aniet. al., 2016).

**Anti-diabetic activity:** Upon incubation of increasing concentration of hemoglobin plant extract inhibited hemoglobin glycosylation which was higher as compared to standard drug (alpha tocopherol). The glucose uptake was found to increase when yeast cells were treated with ethanolic plant extract compared to stand drug, Metformin. The higher activity was observed in 10mg/ml of plant extract. The plant showed concentration dependent reduction of alpha amylase enzyme compared to standard drug Metmorphin (VRMadhuri et. al, 2016).

**Anthelmintic effects:** The ethanolic and methanolic extract of *Murrayakoenigii* fruits shows anthelmintic effects against the Indian earthworm (*Pheretima posthuma*) in a dose dependent manner; Piperazine citrate (15mg/ml) was selected as standard drug. Ethanolic and petroleum ether extract were taken at 50 mg/ml, 100 mg/ml, 150 mg/ml and 200 mg/ml. Both the extract possesses significant activity while the ethanolic extract showed better anthelmintic activity than petroleum ether extract. The ethanolic extract (at 200mg/ml) causes the paralysis of Indian earth worm at 23.33 minutes and promotes lethal effect at 95.33 minutes (AN Waghmare et. al., 2015).

## Conclusion

Since every part viz. root, stem, bark and leaves of the plant is useful, a wide range of study has been done from its stem up to its bark. This review compiles various aspects of *Murrayakoenigiion* which research has been done and provides a better awareness toward its therapeutic and non-therapeutic properties. Pharmacological studies, for further research towards knowing its unknown pharmacodynamic properties.

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