

Mini review on *Mallotus philippinensis* (Lam.) Muell. Arg. (*Kampillaka*)

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Abstract

Mallotus philippinensis (Lam.) Muell. Arg. (Family: Euphorbiaceae) is a medicinally important common perennial tree used in indigenous systems of medicine. It is distributed chiefly in the tropical and subtropical regions of the world. Though, it is a drug of herbal origin it has been categorized as one among eight *Sadharana rasa* in *Rasa-shastra* (Ayurveda study of minerals and metals) of Ayurveda pharmacopoeia. *M. philippinensis* is included in *Virecana ghana* of Ayurveda medicine. Specially roots, fruits and fruit powder and the leaves are used for medicinal purposes. Leaves are bitter, cooling and appetizer, the glands/hairs of the fruit and the leaves are recommended for dermal problems. Many scientific investigations have been carried out to validate and investigate the pharmacological activities of *M. philippinensis*. In the present study, an attempt was taken to summarize distribution, morphology, traditional uses and scientific investigations on *M. philippinensis*.

Keywords: Health benefits *Mallotus philippinensis* (Lam.) Muell. Arg., , Pharmacological activities

Introduction

Mallotus philippinensis (Lam.) Muell. Arg. (Family: Euphorbiaceae) is a large genus of trees and shrubs distributed chiefly in the tropical and subtropical regions of the world with around 20 species in India¹.

Mallotus philippinensis (*M. philippinensis*) commonly called in Sanskrit: *Kampilya*, *Kampillaka*, *Raktaphala*, *Recana*, in Sinhala: *Hamparila*, in English: *Kamala* and in Tamil *Kapila*². Though, *M. philippinensis* is a drug of herbal origin it has been categorized as one among eight *Sadharana rasa* in *Rasa-shastra* (Ayurveda study of minerals and metals) of Ayurveda pharmacopoeia.

It is a common perennial tree, medicinally important plant used in indigenous systems of medicine. Trees

are small to medium-sized monoecious in nature, up to 25 m tall and with a bole up to 50cm in diameter, but usually much less in number. Leaves are alternate and simple, more or less leathery, ovate to lanceolate, cuneate to round with two glands at base. Leaves are mostly acute or acuminate at apex, conspicuously 3-nerved, hairy and reddish glandular beneath, petiole size 1–4cm long, puberulous and reddish-brown in color. Male flowers in terminal and axillary position, 2–10cm long, solitary or fascicled paniculates spikes, each flower is with numerous stamens, small; female flowers have spikes or slender racemes, each flower with a stellate hairy, 3 celled ovaries with 3 papillose stigmas. Fruit is a depressed-globose; 3-lobed capsule; 5, 7 mm, and 10 mm; stellate; puberulous; with abundant orange or reddish glandular granules; 3-seeded. Seeds are subglobose and black in color and 4 mm across³. Mature fruits have glandular hairs and they collected as reddish brown powder. Specially roots, fruits and fruit powder and the leaves are used for medicinal purposes. Leaves are bitter, cooling and appetizer. Although, the glands/hairs of the fruit is the common use part of this herb for medicinal preparations and this pure red powder is not freely available in the market.

Pharmaco-dynamic properties of *M. philippinensis* are, *Rasa: Katu*, *Amla*, *Guna: Ushna*, *Ruksha* and *Teekshna*, *Virya: Ushna*, *Vipaka: Katu*, *Dosha Karma: Kapha Vata shamaka*, *Karma: Rechaka*, *Krimighna*, *Vibhedi*, *Ama - pachana*, *Deepana* and *Asrajit*. *Rogagnata: Krimi*, *Twak roga*, *Vruna*, *Vibandha*, *Gulma*, *Udara*, *Arshas*, *Shula*, *Jvara*, *Prameha* and *Prabhava: Recaka*. *M. philippinensis*, an *Audbhida dravya* is well described in Charaka and Sushruta samhita-Ayurvedic classics of ancient traditional medicine of India but, it was not much used in recipes of traditional medical system of Sri Lanka respectively.

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M. philippinensis is including in *Virecana ghana* of Ayurveda medicine.

Different preparations such as powders- *Kampillaka churna* for *Gulma*, *Udavarta*, *Krimi*, *Patolamuladi churna* for *Udara*, *Vatika-Krimighatani vati* for *Krimiroga*, *Malahara* -“*Kajjali Kodaya Malahara*” for wound cleansing, healing and chronic wounds for quick healing activity, *Varti- Krimignadi varti*, and oils –*Vipadikahara grita taila* are some examples which were mentioned in Ayurveda classics. Availability of these prepared medicines is less in market in Sri Lanka.

Health benefits of *Mallotus philippinensis*

Some traditional uses of this plant were mentioned in Ayurvedic classics. The glands/hairs of the fruit and the leaves of *M. philippensis* are recommended for dermal problems and the oil prepared with fruit powder and the gingili oil is better for wound healing⁴. Powder of *M. philippinensis* (glands/ hairs of the fruit) properly mixed with coconut oil can be applied for *Pama kushtha* (skin lesion with white and red, black, itchy eruptions), burning wounds and other wounds also⁵. *M. philippensis* is used to dress wounds, burns and the oil of *M. philippensis* cleanses chronic infected wounds. In dermatitis, especially of the oozing type, is considered to be a valuable remedy⁶. In addition, tincture of *M. philippensis* is prescribed for worm treatments as it contains purgative properties other than the wormicidal activity². The dose of 1.5 g - 2g of fruit powder with *Guda* (Jaggery of sugarcane) is better for intestinal worms². Along with this medicinal importance, this plant is used against human pathogens including *Helicobacter pylori*, anti-inflammatory activity, anti-allergic, anti-HIV activity, and many more³. When the fruit powder is mixed with *Shatadautagrita* (ghee prepared by 100 times washing) is better for hair falling. Also *M. philippensis* contains blood purifying and aphrodisiac properties⁵. *M. philippinensis* fruit is purgative, detergent, carminative, alexiteric and useful in treatment of bronchitis, abdominal diseases, spleen enlargement etc and if taken with milk or curd (yoghurt), it can be quite useful for expelling tapeworms⁷. The crude powder of kamala obtained as a glandular pubescence from the exterior of fruits is found to be useful in case of worm, hook worms, round and earth worms, anthelmintic activity. The drug was found to be 100% effective against tape worms⁸.

Fruit powder of *M. philippinensis* is one of the main ingredients of *Vipadikahara grita taila* is a medicated oil which was mentioned in Caraka Samhita under the *Kushta chikitsa* as a treatment for five types of skin diseases-*Vipadika*, *Carma kushta*, *Eka kushta*, *Kitibha* and *Alaska*⁹. Scientifically, the efficacy of *Vipadikahara grita taila* against *Vipadika*- a skin disease with fissures of palms and feet with severe pain, was proven by Hewageegana and co-workers¹⁰. Further, *Vipadikahara grita taila* showed potent antibacterial activity against *Streptococcus pyogenes*, by agar well diffusion method by measuring the zone of inhibition¹¹.

Following are some positive scientific aspects which *M. philippinensis* is taken as a drug itself.

Antimicrobial Activity

The antimicrobial activity of hexane, chloroform and ethanol leaf extract showed significant activity against the human pathogens such as *Streptococcus pneumonia*, *Proteus vulgaris*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Vibrio* species and the fungus *Candida albicans*. The antimicrobial activity of the tested extracts showed dose dependent activity against all the tested bacteria with the zone of inhibition ranged from 12-26 mm. However, only the ethanol extract showed antimicrobial activity against the tested fungus *Candida albicans* and with the zone of inhibition ranged from 16-22 mm¹². Antimicrobial activity of hexane, chloroform and methanol extracts of stem bark of *M. philippinensis* was investigated against *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Salmonella typhi* and *Bacillus subtilis*. Except hexane extract, other extracts showed significant antimicrobial activity against tested bacterial spp.¹³. According to Zaidi and co-workers (2009)¹⁴, 70% ethanolic extract and its constituents of *M. philippinensis* (at the concentration of 15.6–31.2mg/L) showed potent antimicrobial activity against *Helicobacter pylori*. Further, purification of extract revealed that rattler in exhibits potent bactericidal effect with minimal bactericidal concentration (MBC) of 3.12– 6.25mg/L especially against clarithromycin and metronidazole resistant *H. pylori* strains to prevent further surge in resistant antibiotics.

Hepatoprotective activity

Hepatoprotective activity of the methanolic extract was studied against various hepatotoxicants such as ethanol and carbon tetrachloride in rats. Physical (wet liver weight and volume), biochemical (Serum Glutamic Oxaloacetic Transaminase, Glutamic Pyruvic Transaminase, Alkaline phosphate, direct and total bilirubin, total protein, cholesterol, triglyceride), Antioxidant Parameters (Catalase, Superoxide Dismutase, Lipid Peroxidation), Functional (thiopentone induced sleeping time) and histopathological changes of livers were assessed in control/standard/ and extract treated animals exposed to ethanol and carbon tetra chloride hepatotoxicants in rats. When compared to ethanol and carbon tetra chloride toxicant groups the increased thiopentone sleeping time, wet liver weight and wet liver volume was markedly reduced in methanolic extract treated groups. The toxicants induced a rise in the plasma enzyme levels of Serum glutamate oxaloacetic transaminase, Serum glutamate pyruvic transaminase, Total cholesterol, Total bilirubin, direct bilirubin, Triglycerides, Alkaline phosphatase and Thiobarbituric acid reactive substance (TBARS) like Malonaldehyde. This increase in the enzyme levels were significantly lowered by the extract at 100 mg/kg and 200mg/kg. Total protein was found to be decreased compared to normal control group. The toxicant decreased Catalase and SOD activities of liver. These activities were significantly increased by the extract of 100 mg/kg and 200mg/kg. The histo-pathological changes i.e. fatty changes (steatosis), necrosis etc were partly or fully prevented in animals treated with the extract¹⁵.

Anti-Leukemic Activity

Root extract of *M. philippinensis* was tested on human promyelocytic leukemia HL-60 cell proliferation, cell cycle regulators, and apoptosis in order to investigate its antileukemic effect. Hexane fraction showed promising toxicity against p53-deficient HL-60 cells (IC₅₀ 1.5 mg dry roots equivalent/mL medium) after 72 h and, interestingly, inhibition of cell proliferation was preceded by the upregulation of the protooncogenes Cdc25A and cyclin D1 within 24 hours suggesting its antileukemic effect in HL-60 cells¹⁶.

Anti-HIV Activity

Four phloroglucinol derivatives isolated from *M. philippinensis* were tested for their ability to inhibit the activity of human immunodeficiency virus- (HIV-) reverse transcriptase. The mode of inhibition of mallotojaponin was found to be competitive with respect to the template primer, (rA)_n (dT)₁₂₋₁₈, and noncompetitive with respect to the triphosphate substrate, dTTP. The K_i value of mallotojaponin for HIV-reverse transcriptase was determined to be 6.1 μ M¹⁷.

Anti-inflammatory activity

Anti-inflammatory activity was evaluated using ethanol (50%) extract of glandular hairs of *M. philippinensis* fruits in Charles-Foster albino rats. Three animal experimental models were used: (a) carrageenan (acute) (b) turpentine oil induced formalin (sub-acute) induced paw edema (c) granuloma pouch (sub-acute). *M. philippinensis* at a dose of 200 mg/kg at 3 h after their administration showed inhibition of formalin-induced paw edema by 41.60% and carrageenan-induced paw edema by 55.30%. After 7 days of treatments, *M. philippinensis* showed 38.0% inhibition against formalin-induced paw edema and reduced weight of turpentine induced granuloma pouch by 29.6% and volume of exudates by 26.1% respectively¹⁸. Daikonya and co-workers¹⁹ have shown inhibition of nitric oxide (NO) production and inducible NO synthase (iNOS) gene expression by a murine macrophage-like cell line (RAW264.7) which was activated by lipopolysaccharide (LPS) and recombinant mouse interferon-gamma (IFN-gamma) using the hexane fraction of acetone extract of *M. philippinensis* fruits. In addition, suggest the down regulation of cyclooxygenase-2 gene, interleukin-6 gene, and interleukin-1b gene expression.

Analgesic and hypnotic activity

Analgesic activity was evaluated using ethanol (50%) extract of glandular hairs of *M. philippinensis* fruits in Charles-Foster albino rats. Three animal experimental models were used: tail-flick, hot-plate, and acetic acid-induced writhing tests. Results revealed that *M. philippinensis* at a dose of 200 mg/kg, showed dose-dependent elevation in pain threshold and peak analgesic effect at 120 min as evidenced by increased latency period in tail flick method and increased reaction time in the hot-plate test while the reduction in the number of acetic acid-induced writhes by

45.7%. Hypnotic activity was investigated by pentobarbitone-induced hypnotic potentiation in rats and sleeping duration was significantly prolonged in rats treated with *M. philippinensis* at a dose of 200 mg/kg¹⁸.

Antioxidant activity

Extracts of *M. philippinensis* fruits and bark were evaluated for total antioxidant activity, DPPH (2,2-diphenyl-1-picrylhydrazyl radical) scavenging activity, reducing power, total phenolics and tannin contents. The extract of the bark showed the strongest antiradical activity and reduction power^{20, 21}.

Conclusions

Present review confirms the medicinal values of *Mallotus philippinensis* and it can be used against human pathogens and a promising candidate for hepatoprotection, anti-leukaemic, anti-HIV, anti-inflammatory, analgesic, hypnotic, antioxidant potential and healing skin lesions. These findings may lead to further development of novel pharmaceutical preparations from *M. philippinensis* in the future.

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