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MALLOTUS PHILIPPENSIS: A MIRACLE STICK

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ABSTRACT

Mallotus philippensis is one of the endangered medicinally important plants used in indigenous system of medicine for cultivation prospects. It is an important medicinal shrub of Ayurvedic system; whole parts of the plants are rich in secondary metabolites. Various parts of the plant are used in the treatment of skin problem, bronchitis, abdominal disease, jaundice, malaria, antifungal, tape-worm, eye-disease, cancer, diabetes, diarrhea, urinogenital infection etc. It also possesses various pharmacological activities like anti-oxidant, Antimicrobial Activity, Antifilarial Activity, Anti-LeukaemicActivity, Antitumor Activity, anti-HIV Activity, Anti-tuberculosis Activity Hepatoprotective Activity. This review underlines the miracle activities of the *Mallotus philippensis*.

INTRODUCTION

India has a rich bio diversity of medicinal and Aromatic plants and holds a unique place in the world in the traditional system of medicine.[1] Indigenous medicinal plants are great importance to the health of individuals and to communities. The medicinal activity of the plants may be due to the presence of bio-active chemical constituents such as flavanoids, tannins, terpenoids, alkaloids and glycosides.[2]

In Ayurveda different types of medicinal preparations are used to external and internal ailments by utilizing special parts of medicinal plants such as the leaves, seed, stem bark, flowers, roots etc.[3]

The genus *Mallotus* comprises of about 150 species in the world and about 20 species alone have been reported in india.[4] *Mallotus philippensis* locally known as kamala is a large

woody multipurpose medicinal tree belongs to family Euphorbiaceae consisting of herbs, shrubs and trees. The bark of *Mallotus philippensis* has been used for typhoid and meningitis.[5] The gland and the hairs of the fruits are used in the treatment of intestinal worms and also as a purgative. Its oil is used in dermal problems and non healing wounds.[6] The leaves are used externally for different types of skin infections and infected wounds.[7] The glands/hairs of the fruit mixed with coconut oil is used to dress wounds and burns and the oil of *Mallotus philippensis* cleanses chronic infected wounds. In dermatiles especially of oozing type, *Mallotus philippensis* is considered to be a valuable remedy.[8]

(1)

Fig 1: Overview of *Mallotus philippensis* tree

(2)

Fig 2: Mature fruits of *Mallotus philippensis*

Scientific Classification

Kingdom:	**Plantae**
Division:	Magnoliophyta
Class:	Magnoliopsida
Order:	Euphorbiales
Family	Euphorbiaceous
Genus	*Mallotus*
Species	*philippinensis*

Vernacular Names

Hindi:	**Kamala, Sindur, Rohini and Kambhal**
English:	Monkey-face tree
Tamil:	Kapli, Kungumam, Kurangumanjanatti
Telgue:	Kapli, Kunkuma, Sinduri,Chendiramu
Assam:	Gangai, Puddum, and Lochan
Sanskrit:	Kapila, Kampillaka

Ecology

Mallotus philippensis has a widespread natural distribution, from the western Himalayas, through India, Sri Lanka, to southern China and throughout Malesia to Australia. Sometimes it is gregarious but more usually mixed with other species, both in forests and open scrubland. Kamala tree is common in evergreen forest, especially in secondary forest, and sometimes even dominant in the undergrowth. Kamala tree withstands considerable shade; it is frost-hardy and resistant to drought.[9]

Biophysical limits

Temperature- 16-28 ^{0}C

Annual rainfall – 800-2000 mm

Soil- It grows mostly in every soil types, including in fertile soi, limestone and rocky lands.[10]

Morphology

Trees

Trees are small to medium sized monoecious in nature, upto 25m tall and with a bole up to 50 cm in diameter, but usually much less in number. Slash turning deep red, branchlets are reddish brown glandular.

Leaves

Leaves are alternate and simple, more or less leathery, ovate to lanceolate, cuneate to rounded with two glands at base. Leaves are mostly acute or acuminate at apex, conspicuously 3-nerved, hairy and reddish glandular beneath, petiole size 1-4 cm long, puberulous and reddish-brown in color.

Flowers

Flowers are small unisexual. Male flower in terminal and axillary position, 2-10cm long, solitary or fascided paniculates spikes, each flower are with numerous stamens small; each flower with stellate hairy, 3 called ovary with 3-papillose stigmas.

Fruit

fruit is a depressed-globose; 3-lobed capsule; 5,7mm and 10mm; stelate; puberulous; with aboundant orange or reddish glandular granules; 3-seeded.

Seed

Seeds are subglobose and black in color and 4 mm across.[11]

Biology

In this genus, *Mallotus philippensis* flowers mature from March to April and fruits mature in July-August. *Mallotus philippensis* has extra floral nectarines attracting ants.[12]

Traditional Uses

According to Ayurveda, leaves are bitter, cooling and appetizer. All parts of plant like glands and hairs from the capsules or fruits are used as heating, purgative, anthelmintic, vulnerary, detergent, maturant, carminative and alexiteric. It is also useful in treatment of bronchitis, abdominal disease, and spleen enlargement and if taken with milk or curd (yoghurt). It can be quite useful for expelling tapeworms. Kamala is also used as an oral contraceptive. The powder and a few other parts of kamala are also used in external applications to promote the healing of ulcers and wounds. They are used to treat parasitic affections of the skin like scabies, ringworm and herpes.[13]

Phytochemical constituents

Fruits

Fruits contain Rottlerin (reddish yellow resin) 47.80% fixed oil 5.83-24% mallotoxin, kamalin, Oleic lauric, myristic, palmitic acid, stearic acid, crotoxigenin, rhammoside, octa casanol, iso rottlerin, rottlerin, homorottlerin tannins, citric acid and oxalic acid.[14,15]

Stem bark

The chemical constituents like betulin, friedelin, kamaladiol-3-acetate, lipeol, tannic acid, 3-hydroxy-D-A-friedoolean-3-en-2-one, 2β-hydroxy-D-A-friedooleanan-3-one and 3α-hydroxy-D-A-friedooleanan-2-one, were reported from the stem bark.[16,17,18,19]

Seed

The seed contains a Fixed oil, camul oil and a bitter glucosidal, Betulin-3 acetate lupeol acetate, berginin acetylaleuritote acid, sitosterol, bergenin, rottlerin resin, solid hydroxy acid, kamlonenic acid, linoleic, Oleic, lauric, myristic, palmitic acid, stearic acid, crotoxigenin, rhamnoside, coroghcignin, octa cosanol, iso rottlerin, rottlerin, homorottlerin, tannins, citric and oxalic acidp.[20]

Common Adulterants

Glandular hair powder of *Mallotus philippensis* is commonly adulterated with Annato dye (Bixa orellana Linn.), ferric oxide, brick dust and ferruginous sand. Casearia tomentosa (stem bark powder), Carthamus tinctorius (flower powder), Ficus benghalensis (fruit powder) and Flmingia macrophylla (hairs of fruits) are also reported to be used as adulterant or substitute of kampillaka.[21]

Pharmacological Activities

Antioxidant activity and Antiradical Activity

Several extracts from *Mallotus philippensis* fruits and bark were prepared and evaluated for their total antioxidant activity (TAA), antiradical activity against DPPH (2,2-diphenyl-1-picrylhydrazyl radical) and reducing power. The total phenolics and tannin contents in extracts were determined. The extract of the bark showed the strongest antiradical activity and reduction power; its TAA was 5.27 mmol Trolox equivalents/g. The TAA of other extracts ranged from 0.05 to 1.79 mmol Trolox equivalents/g extract. The content of total phenolics in the bark extract was 541mg/g.[22,23]

Antimicrobial Activity

The antimicrobial activity of hexane, chloroform and ethanol leaf extract showed significant activity against the human pathogens such as *Streptococcus pneumoniae* causing brain abscesses, pneumonia and septic arthritis, *Proteus vulgaris*, *Pseudomonas aeruginosa* causing urinary tract infections and septicaemia, *Salmonella typhi* causing typhoid fever, *Vibrio* species causing diarrheal infections and the fungus *Candida albicans*. The antimicrobial activity of the hexane, chloroform and ethanolic stem extract showed concentration-dependent activity against all the tested bacteria with the zone of inhibition ranged from 12-26mm at various concentrations. But only the ethanol extract showed antimicrobial activity against the fungi *A. flavus* and *C. albicans* with the zone of inhibition ranged from 16-22mm at various concentrations.[24]

Antifilarial Activity

The effect of aqueous and alcoholic leave extracts of *Mallotus philippensis* (Lam.) was studied on the spontaneous movements of the whole worm and nerve-muscle (n.m.) preparation of *Setaria cervi* and on the survival of microfilariae *in vitro*. Both the extracts result in inhibition of spontaneous motility of whole worm and them n.m. preparation of *S.*

cervi characterized by initial stimulation followed by depression in amplitude. The tone and rate of contractions remained visibly unaffected. Aqueous extract at higher concentration showed immediate reduction in tone. The concentration required to inhibit the movements of n.m. preparation was 1/5th for aqueous and 1/11th for alcoholic extract compared to that for the whole worm, suggesting a cuticular permeability barrier. The stimulatory response of acetylcholine was blocked by aqueous extract on whole worm movements. On the microfilariae the LC50 and LC90 were 18 and 20 ng/mL for aqueous and 12 and 15 ng/mL for alcoholic extracts, respectively.[25]

Anti-LeukaemicActivity

The root extract of *Mallotus philippensis* 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 1.5mg dry roots equivalent/mL medium) after 72h 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 cells. After isolation and identification by GC-MS, polyphenols were the main compounds of the hexane extract that inhibited proliferation and induced apoptosis.[26]

Anti-HIV Activity

Four phloroglucinol derivatives, named mallotophenone (5-methylene-bis-2,6-dihydroxy3-methyl-4-methoxyacetophenone), mallotochromene (8acetyl-5,7-dihydroxy-6-(3-acetyl-2,4-dihydroxy-5-methyl-6methoxybenzyl)-2,2-dimethylchromene), mallotojaponin (3-(3,3(dimethylallyl) S-(3(acetyl-2,4-dihydroxy-5-methyl6-methoxybenzyl)-phloracetophenone) and mallotolerin (3(3-methyl-2-hydroxybut-3-enyl)-5-(3-acetyl-2,4-dihydroxy5-methyl-6-methoxybenzyl)- phloraceto-phenone) 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 *Ki* value of mallotojaponin for HIV-reverse transcriptase was determined to be 6.1μM.[27]

Antitumor Activity

Four known friedelane-type triterpenoids, friedelin, 3-hydroxy-D:A-friedoolean-3-en-2one, 2β-hydroxy-D:A-friedooleanan-3-one, and 3α-hydroxy-D:A-friedooleanan-2-one, and two

known lupanetype triterpenoids, lupeol and betulin, were isolated from the stem bark of *Mallotus philippensis* and were tested for their inhibitory effects on Epstein-Barr virus early antigen (EBV-EA)activationinducedby12-O-tetradecanoylphorbol 13-acetate (TPA). The inhibitory effect of compounds 2 (IC50 = 292mol ratio/32pmol/TPA) and 4 (IC50 = 288) was stronger than those of the other compounds tested and the positive control, curcumin (IC50 = 343). Compound 3*α*hydroxy-D:A-friedooleanan-2-one strongly inhibited mouse skin tumor promotion in an in vivo two-stage carcinogenesis model.[28]

Anti-tuberculosis Activity

Organic extract of *Mallotus* plant which yields five compounds after bioassay directed fractionation. The most active compound against Mycobacterium tuberculosis was 8-cinnamoyl5, 7-dihydroxy-2, 2-dimethyl- 6-geranylchromene for which the name mallotophilippen-F is suggested. The second compound 8-cinnamoyl-2,2- dimethyl-7-hydroxy-5-methoxychromene was isolated from a natural source for the first time, while the remaining three compounds, rottlerin, isoallorottlerin, or isorottlerin and the so-called red compound, 8-cinnamoyl-5,7-dihydroxy-2, 2, 6-trimethylchromene, had been already isolated from this plant. Isolated compounds were identified by 2D-NMR and C-13 NMR.[29]

Anti-Inflammatory and Immunoregulatory Activity

Chalcones derivatives from the fruits of *Mallotus philippensis* and mallotophilippens C, D, and E inhibit 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). Further investigations suggest the downregulation of cyclooxygenase-2 gene, interleukin-6 gene, and interleukin-1b gene expression. The above results show that these chalcones have good anti-inflammatory and immune-regulatory effects.[30]

Hepatoprotective Activity

Methanolic extract of *Mallotus philippensis* leaves decreases the CCl_4-induce delevation in biochemical parameters (SGOT, SGPT, SALP, direct bilirubin, total bilirubin and MDA) on pretreatment at doses100–200mg/kg and also reversed the functional and antioxidant parameters. This study suggests that leave extract was effective in functional improvement of hepatocytes. Histopathological studies also suggest the hepatoprotective activity of plant.[31]

CONCLUSION

In conclusion, this review confirms the great potential of *Mallotus philippensis*. This plant has an immense medicinal and economic use in different system of medicine in India as well as throughout the world. Along with this medicinal importance, this plant is used against human pathogens including anti-inflammatory activity, antioxidant, antiradical, protein inhibition, hepatoprotactive, anti-HIV activity and many more. This review underlines the interest to continue the study of this genus of the Euphorbiaceae family.

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