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Millingtonia hortensis Linn. - a review

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Summary

Millingtonia hortensis (Bignoniaceae) commonly had known as Cork tree, Akas nim and Nim chameli. It is important medicinal plant in Southern Asia ranging from India, Burma, Thailand and South China. The stem bark is used traditionally as mainly lung tonic, anti asthmatic and antimicrobial. The scientific activities reported so far from the plants are antifungal, larvicidal, antioxidant and antiproliferative activities. The present study gives the detailed literature search on pharmacognosy, phytochemistry and pharmacological activities of the plant.

Key words: *Millingtonia hortensis*, Pharmacognosy, Phytochemistry, Pharmacological activities, review.

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Introduction

*Millingtonia hortensi*s (Bignoniceae), commonly known as Cork tree. It is also called as Akas nim, Nim chameli. It is found in the Central India, Myanmar (Burma) and Thailand. *Millingtonia hortensis*, the sole species in genus *Millingtonia* is a tree native to South-East Asia. The name *Millingtonia* comes from Thomas Millington, an English botanist, while *hortensis* means grown in gardens. The tree is favorite garden and avenue tree[1].

PLANT PROFILE

Scientific/Taxonomical Classification

Kingdom: Plantae
Division: Magnoliophyta

Class: Magnoliopsida
Order: Lamiales
Family: Bignoniaceae
Genus: *Millingtonia*
Species: *hortensis*

Synonyms:
1 *Bignonia suberosa* Roxb.
2 *Millingtonia hortensis* L. f

Common Names
English: Tree Jasmine
Hindi: Nim chameli
Kannada: Beratu
Telugu: Kavaki
Tamil: Maramalli


Fig 1: Leaves of *M.hortensis*


Fig 2: Stem bark of *M.hortensis*

Distribution
It is important medicinal plant in Southern Asia ranging from India, Burma, Thailand and South China.

Description
It is a tall deciduous tree. It grows up to 25 meter. It has corky bark and straight trunk and has few branches. It flowers at night and shed flowers early in the morning. In the cooler months, the tree blooms in the night and early in the morning; fragrant flower falling and carpeting the ground around.

Leaves: Leaves are very ornamental, Leaves opposite, tripinnately compound,exstipulate, petiolate, the upper tertiary leaflets sessile, exstipellate, leaflets ovate lanceolate,the bases rounded or cuneate, the margins serrate, the tips acuminate, pubescent when young (Fig 1).

Inflorescence: Inflorescences in paniculate cymes, terminal or axillary, the cymules 3-flowered; bracts minute.

Flowers: Flowers are white, waxy, trumpet-shaped and somewhat two lipped with five sub equal lobes. The flowers are in corymbose, long tubular, white and fragrant; ebracteolate, pedicellate, zygomorphic, pentamerous, hypogynous. Calyx synsepalous 5- toothed, campanulate. Corolla synpetalous, 5-lobed,infundibuliform, the tube long, slender, cylindrical, white; androecium didynamous, stamens 4,epipetalous, the filaments shortly exerted, the anthers

dithecous, one cell ovoid, the second cell appearing as a small hook, white, dehiscence longitudinal; disc small, cushion-like; pistil 1, ovary sub sessile, 2- carpelled, syncarpous, 2-loculed, the placentation axile, the ovules numerous in each locule, the style long, the stigma 2-lobed, ellipsoid.
Fruit: Fruit is a 2-valved septicidal capsule, oblongoid, acute at both ends, flat, woody; seeds discoid, compressed, winged, except the base, the wing narrow at the apex, non endospermic.
Flowering period: October to December.
Fruiting period: November – February[2].

PHARMACOGNOSTICAL CHARCTERISTICS

Macroscopic characters
Leaves: The leaves are large, two to three pinnate and the leaflets are shine, dark green and with toothed edges. Drug occurs in 6-20 cm long, 0.3-0.5 cm thick cut pieces almost cylindrical internodes, smooth, stout, mostly covered with shining sheath having distinct nodes, brownish yellow, a few thin fibrous, ash colored roots at nodes. The leaves give no odor and are slightly bitter in taste (Fig 1).
Stem bark: It is dark brown colored and characteristic odor (Fig 2). The inferior cork is processed from its corky bark. Externally rough with irregular ridges and fissures[1,2].

Microscopic characters
Stem bark: The Transverse section of stem bark shows epidermis with 2-3 layered tangentially elongated cell surrounded by cuticle. It shows cortex consisting of 25 to 30 rows of parenchymatous cells along with lignified medullary rays at one side in parenchymal cells. It shows phloem, xylem, pith and sclerenchyma respectively.

Traditional Uses
Flowers: Flower buds are used in the treatment of asthma, sinusitis, cholagogue and tonic. The flowers are used in rituals. The flowers are added to tobacco for smoking as treatment for throat ailments.
Stem: Stem also having great medicinal value using as lung tonic and cough diseases.
Bark: used as a yellow dye.
Leaves: Leaves and roots of cork tree used as anti asthmatic and antimicrobial activity.
Whole plant: Antipyretic, antitubercular, antimicrobial, larvicidal, antimutagenic, anticancer, antifungal[1,2].

Phytochemical Studies

Flowers:Hispidulin[3]; Scutellarein, scutellarein-5-galactoside[4];Hortensin[5], Cornoside, recimic rengyolone, rengyoside B, rengyol, rengyoside A and iso rengyol[6]; Millingtonine[7].
Leaves: Hispidulin, ßcarotene, dinatin, rutinoside[3].
Bark: Bitter substances and tannins[3].

Pharmacological Studies

Antimicrobial Activity

The essential oil of flowers extracted by using vapor distillation with 0.5-2% yield, tested against various species of bacteria like 4 gram-positive bacteria *(S.aureus* ATCC 25923,

S.epidermidis ATCC12228*, B.subtilis* ATCC6633 *and L.Plantarum* ATCC14917) and 2 of gram negative bacteria *(E.coli* ATCC25922 *and P.vulgaris* ATCC13315). In this study, *M.hortensis* Linn. essential oil of flower showed broad spectrum antimicrobial activity at low concentrations[8].

The polar extracts of the leaves of *M. hortensis* showed good antimicrobial activity. Twenty different bacterial strains and two yeast cultures were used .The aqueous alcohol extract showed good activity against all microbes tested particularly against *Escherichia coli* and S*almonella typhimurium*. Both Gram-negative bacteria, with MIC values of 6.25 µg/ml. The activity is compared with known antibiotics such as gentamycin and nystatin[9].

Induction of Apoptosis on RKO Colon Cancer Cell Line:

The effects of aqueous and ethanol extracts of *M.hortensis* on the induction of apoptosis in an RKO human colon cancer cell line was evaluated. Viability of RKO cells was assessed by MTT reduction assay. The aqueous extract, but not the ethanol extract of *M. hortensis* inhibited cell growth and proliferation in a dose- and time-dependent manner. Apoptotic cells were determined by flow of cytometry and DNA fragmentation assay. Apoptic cell numbers increased in a dose-dependent manner after treatment with aqueous extract. DNA ladders were clearly observed in RKO cells treated with 200,300 and 400 µg/ml of the aqueous extract of *M.hortensis* suggesting that it inhibited cell proliferation in an RKO colon cancer cell line via the apoptosis pathway[10].

An aqueous crude extract of this plant has been shown the apoptosis induction on RKO colon cancer cells. However, its mechanism remains unknown. Further, the partially purified crude extract using Sephadex LH-20 and three aqueous fractions were collected. Each fraction was investigated for cytotoxicity using MTT assay. Fraction 1 showed antiproliferative effect on RKO cells with dose-dependent manner, while fraction 2 and 3 had no effect. Induction of apoptosis was determined using flow cytometry and DNA fragmentation method[11].

Mutagenicity and Antimutagenicity Activity:

The mutagenicity and antimutagenicity of hispidulin and hortensin, the flavonoids from *M. hortensis* L. (Bignoniaceae), were performed using the liquid pre incubation method of the *Salmonella/micro some* test. At the highest dose tested, 100 µg/plate, both compounds showed no mutagenicity and no cytotoxicity toward *S. typhimurium* strains TA98 and TA100 either in the presence or absence of S9 mix. However, these substances were antimutagens toward 2-aminoanthracene, aflatoxin B1 (in TA98), and dimethylnitrosamine (in TA100); but neither substance inhibited the direct mutagenic activity of (2-furyl)-3-(5-nitro-2-furyl) acrylamide nor that of sodium azide in strains TA98 and TA100, respectively[12].

Antifungal Activity:

Antifungal activities of different extracts of *M. hortensis* were investigated against various fungal pathogens. Methanol extract was found to have stronger activity than fluconazole against yeast like fungi: 4 fold against *Candida krusei* with 4µg/ml minimal inhibitory concentration and 2 fold (MIC- 2 µg/ml) against *Sacharromyces cerevisiae*, though it showed the same activity as fluconazole against *Candida glabrata.* Aqueous extract also exhibited 4 fold stronger activity against *Candida krusei* (MIC- 4 µg/ml) and 4 fold (MIC; 2 µg/ml) against *Sacharomyces cerevisiae.* Chloroform and ethyl acetate extract showed lower activities against all fungal pathogens except for *Candida krusei,* compared with the standard. Against the filamentous fungus, *Trichosporon cutaneum,* all extracts showed less activity than the standard[13].

Anticonvulsant Activity:

The functional characterization of hispidulin (4′, 5, 7-trihydroxy-6-methoxyflavone), a potent benzodiazepine (BZD) receptor ligand, was initiated to determine its potential as a modulator of central nervous system activity. After chemical synthesis, hispidulin was investigated at recombinant GABAA/BZD receptors expressed by *Xenopus laevis* oocytes. Concentrations of 50 nM and higher stimulated the GABA-induced chloride currents at tested receptor subtypes (α1−3, 5,6β2γ2S) indicating positive allosteric properties. Maximal stimulation at α1β2γ2S was observed with 10 μM hispidulin. In contrast to diazepam, hispidulin modulated the α6β2γ2S-GABAA receptor subtype. When fed to seizure-prone Mongolian Gerbils (*Meriones unguiculatus)* in a model of epilepsy, hispidulin (10 mg Kg bw/day) and diazepam (2 mg Kg bw/day) markedly reduced the number of animals suffering from seizures after 7 days of treatment (30 and 25% of animals in the respective treatment groups, vs 80 % in the vehicle group).

Permeability across the blood–brain barrier for the chemically synthesized, 14cs-labelled hispidulin was confirmed by a rat in situ perfusion model. With an uptake rate (Kin) of 1.14 ml min−1 g−1, measurements approached the values obtained with highly penetrating compounds such as diazepam.

Experiments with Caco-2 cells predict that orally administered hispidulin enters circulation in its intact form. At a concentration of 30 μM, the flavone crossed the monolayer without degradation as verified by the absence of glucuronidated metabolites[14].

Antiasthmatic Activity:

The methanol extract exhibited bronchodilating effect on isolated rat trachea, this extract was further fractionated into petroleum ether, chloroform, n-butanol and aqueous fractions. Pharmacological studies indicated that the chloroform fraction elicited the most prominent effect. Further separation of the chloroform fraction by short column chromatography enabled hispidulin, the bronchodilating agent, to be isolated. Detection by TLC indicated that hispidulin is one of the compounds present in the smoke of the dried flowers. It is therefore likely that the antiasthmatic activity of the dried flowers of *M. hortensis* Linn. is due to hispidulin. Hispidulin is more potent than aminophylline on a molar basis. It was interesting to observe that the aqueous extract of these flowers exhibits a bronchoconstricting action which gradually diminishes upon storage[15].

Larvicidal Activity

M. hortensis a plant commonly known as 'Akas neem' leaf extract (Acetone extract) has been screened against three species of mosquito vectors like *Culex quinquefasciatus, Aedes aegypti and Anopheles Stephensi.* Although some medicinal properties of this plant are known but so far there is no report of its biological activity against insects. The present communication is the first report which reveals the mosquito larvicidal property of *M. hortensis*[16].

Anthelmintic Activity

The present study was undertaken to evaluate anthelmintic activity of different extracts (petroleum ether, benzene, chloroform, methanol and aqueous extracts) of stem bark of Millingtonia *hortensis* (Bignoniaceae) against adult earthworm Pheretima *posthuma*. Piperazine citrate was used as standard reference drug. Among all the extract tested, methanol showed dose

dependent anthelmintic and better activity in comparison with reference standard. Chloroform and benzene extracts at 20 mg/ml concentration also showed similar activity in comparison with piperazine citrate at dose of 60 mg/ml. Aqueous extract was not at all active. Preliminary phytochemical screening revealed the presence of steroids, flavonoids and tannins in different extracts[17].

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