IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Millingtonia Hortensis (A Cork Tree): A Scientific Review

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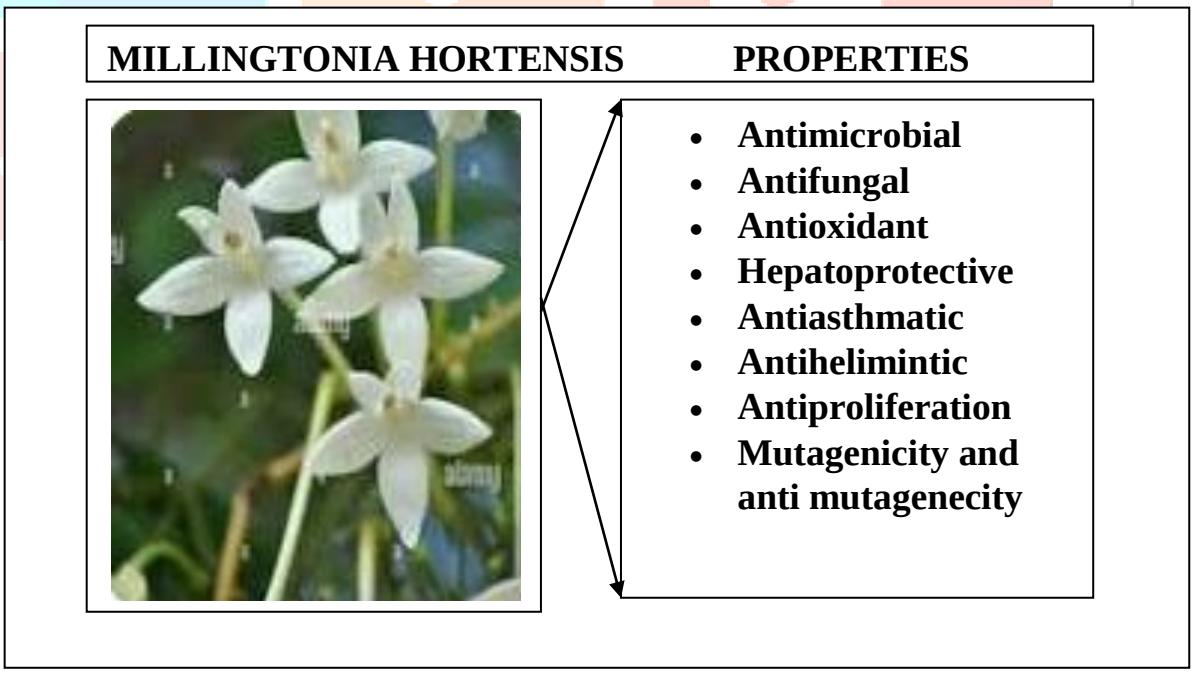
GRAPHICAL ABSTRACT



ABSTRACT:

India is renowned for its rich biodiversity and is often described as a global hub of medicinal plants and traditional healing systems. The country harbors an extensive variety of botanicals such as neem, amla, ashwagandha, turmeric, bael, and Indian cork tree (Millingtonia hortensis), which have long been used for their therapeutic properties [1]. Among these, Millingtonia hortensis stands out as a widely cultivated and highly valued medicinal plant.Millingtonia hortensis Linn., commonly known as the Indian cork tree or jasmine tree, is admired both for its ornamental appeal and medicinal efficacy. Native to Southeast Asia and extensively cultivated in India, this species is typically grown along roadsides, in gardens, and on avenues

for its aesthetic and aromatic value [2].Millingtonia hortensis is a tall, fast-growing, evergreen tree that can reach a height of 18 to 25 meters and spreads up to 7 to 11 meters [3]. It is characterized by a straight trunk with few branches and corky bark, which contributes to its common name. The leaves are opposite, imparipinnately bipinnate, with ovate-lanceolate leaflets that are serrate and acute in shape [4]. The white, tubular flowers bloom during the night and fall by morning, releasing a sweet and pleasant fragrance. These flowers appear in large panicles and contribute significantly to the plant's ornamental value.The tree produces flat, two-part capsules containing numerous winged seeds. The wood of Millingtonia hortensis is used locally as timber, while the bark serves as a low-grade substitute for true cork [5]. The plant demonstrates high adaptability to different soil types and climatic conditions, making it a robust species suitable for varied landscapes.Millingtonia hortensis is cultivated extensively in both tropical and subtropical regions. It flowers mainly from April until the onset of the monsoon and again during November and December [6]. The tree thrives in well-drained soils and prefers full sunlight, although it is also tolerant of partial shade. Its resilience and ease of propagation contribute to its popularity as a roadside and garden plant.Various parts of the tree—leaves, flowers, bark, seeds, and roots are traditionally used in Indian systems of medicine. These parts are known for the following therapeutic effects:Anti-asthmatic: The leaves and flowers are used in the treatment of asthma, bronchitis, and other respiratory ailments. The bronchodilatory properties have been validated in pharmacological studies [7].Antimicrobial: Extracts from the bark and flowers have demonstrated antibacterial and antifungal properties against various microbial strains [8].Anti-inflammatory: The plant contains flavonoids and phenolic compounds that inhibit inflammation and provide analgesic relief [9].Hepatoprotective: Preliminary studies suggest that ethanol extracts of Millingtonia hortensis may offer protection against liver damage caused by toxins [10]. Beyond its medicinal applications, Millingtonia hortensis has multiple practical uses:Its bark, although inferior to true cork, is used in corkboard and insulation material [5].The timber, though soft, is suitable for making light furniture and matchsticks.Leaves are occasionally used in smoking mixtures and local tobacco products [11].The tree also plays an ecological role, providing habitat for pollinators and enhancing urban green spaces. -

KEY WORDS :

Millingtonia Hortensis, Brittle wood, Pleasant smell, Foliage, Capsule like fruits, Hepatoprotective effects.

INTRODUCTION:

Millingtonia hortensis, commonly known as the Indian Cork Tree or Jasmine Tree, plays a significant role in both traditional and modern medicine. Belonging to the family Bignoniaceae, it is one of the prominent medicinal plants native to Southern Asia, including India, Thailand, Myanmar (Burma), and southern China [1, 2]. In India, it is widely recognized by vernacular names such as Akashneem and Neem Chameli [3]. This tall and fast-growing evergreen tree is admired for its ornamental beauty and the pleasant fragrance of its flowers, which bloom at night and shed by morning [4, 5].

The tree propagates primarily through seeds and suckers and has a perennial life span [6]. It is commonly grown in gardens, avenues, and along roadsides due to its rapid growth and aesthetic appeal [7]. In addition to its ornamental value, Millingtonia hortensis is widely recognized for its pharmacological significance and is extensively cultivated throughout India [8].

India has a long-standing tradition of using plants in healthcare, with more than 7,300 plant species documented in its traditional medical systems for treating various ailments [9]. Approximately 90% of these species are used in the form of herbal remedies [10]. In recent years, numerous pharmaceutical industries have started utilizing bioactive compounds from such plants to develop a range of therapeutic drugs [11].

Millingtonia hortensis is particularly noted for its medicinal applications in treating respiratory and microbial disorders. Its flowers are traditionally used in the treatment of asthma and other pulmonary conditions [12, 13]. The leaves are valued as antipyretic agents, especially for conditions like fever and sinus infections [14]. Additionally, the bark is utilized as a lung tonic, and both the leaves and roots are employed as anti-asthmatic and antimicrobial agents [15, 16].

Pharmacological investigations have confirmed a variety of therapeutic properties of Millingtonia hortensis, including:

- Antifungal [17]
- Antibacterial [18]
- Larvicidal [19]
- Antioxidant [20, 23]
- Antiproliferative [27]
- Antihelminthic [26]
- Hepatoprotective [24]
- Anti-inflammatory [22]
- Antidiabetic [29]

These attributes make Millingtonia hortensis a valuable plant for both traditional and contemporary medicine

Taxonomic Profile

Category	Description
Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Lamiales
Family	Bignoniaceae
Genus	Millingtonia
Species	Millingtonia hortensis
Common Names	Indian Cork Tree, Jasmine Tree, Akashneem, Neem Chameli
Synonyms	Bignonia suberosa Roxb., Millingtonia hortensis L., Bignonia azedarachta Koenig & Sims, Bignonia cicutaria Koenig ex Mart.

Millingtonia hortensis is known by various names across different regions and languages in India:

- **Hindi**: Neemchameli
- **Kannada**: Akashmallige, Beratu, Biratemara
- **Konkani**: Akash Nimb
- **Malayalam**: Katesam
- **Marathi**: Akashchameli, Buch, Kavalnimb
- **Oriya**: Bakeni, Mach-Mach, Sitahara
- **Tamil**: Kat-malli
- **Telugu**: Kavuki

These vernacular names reflect the widespread traditional use and cultural significance of the plant in various Indian states [5, 6].

Common Names

- Tree Jasmine
- Indian Cork Tree

Cultivation and Distribution

Millingtonia hortensis is a widely cultivated and ecologically adaptable medicinal plant native to Southern Asia. Its natural distribution spans countries such as India, Myanmar (Burma), Thailand, and southern China [2, 3, 5].

Though indigenous to Burma and the Malay Archipelago, it now grows wild throughout most parts of India and is also cultivated extensively in gardens, parks, and avenues [6, 8]. Its popularity as an ornamental and medicinal tree has led to its propagation across tropical and subtropical climates in India.

Millingtonia hortensis thrives in a variety of soil types and can tolerate semi-arid conditions, making it ideal for cultivation in both urban and rural landscapes. The tree is valued not only for its medicinal importance but also for its role in landscape beautification due to its tall stature, corky bark, and fragrant white flowers [7, 10].

Macroscopic Characters of Millingtonia hortensis

Millingtonia hortensis exhibits distinctive macroscopic features that aid in its identification and therapeutic classification. Each part of the plant contributes specific structural and pharmacognostic traits.

Leaves

The leaves are large, bipinnate to tripinnate, with shiny dark green leaflets and serrated (toothed) margins. Their morphology resembles that of the Neem tree (Azadirachta indica) [ref5]. Leaves are arranged in an opposite fashion on the stem, measuring approximately 0.6 to 0.9 meters in length. They are pinnately compound with an odd number of leaflets. Individual leaflets are ovate to lanceolate in shape, typically 5–7 cm long, and borne on short petioles.

Leaves are vulnerable to infestations by insect pests such as Acherontia styx and Hyblaea puera [ref9]. The crude drug from the leaves is available as cut cylindrical internodal pieces, 6–20 cm in length and 0.3–0.5 cm in diameter. The leaves emit no distinct odor and have a slightly bitter taste [ref3].

Stem Bark

The stem of Millingtonia hortensis is evergreen and pyramidal in shape. The bark is dark brown, rough, and marked with irregular longitudinal ridges. It possesses a distinctive odor. The inner wood is brittle and susceptible to damage from strong winds and storms [ref10].

The corky bark yields an inferior quality of cork, which has been used traditionally in packaging and insulation. The bark is externally fissured and ridged, indicative of its mature form.

Flowers

Millingtonia hortensis bears striking white, trumpet-shaped flowers that contrast vividly with the dark green foliage. Flowers open at night and emit a pleasant fragrance, making the tree popular in ornamental horticulture [ref6, ref20]. The flowers are usually arranged in large panicles and serve both aesthetic and therapeutic purposes.

Fruits

The fruit is a smooth, flat, capsule-type pod, partitioned into two chambers. Each pod contains numerous broad, winged seeds. The fruits are elongated and taper to points at both ends. Birds often consume the fruits, facilitating seed dispersal across wide geographic areas [ref7, ref17].

Phytochemicals of Millingtonia hortensis

Phytochemical screening has revealed a wide range of secondary metabolites in various parts of Millingtonia hortensis. These constituents contribute to its pharmacological actions such as anti-inflammatory, antioxidant, and antimicrobial effects.

S. No.	Phytochemical	Presence
1	Carbohydrates	Present
2	Reducing sugars	Present
3	Proteins	Present
4	Alkaloids	Present
5	Flavonoids	Present
6	Glycosides	Present
7	Phenols	Present
8	Steroids	Present
9	Coumarins	Present
10	Amino acids	Present
11	Terpenoids	Present

These bioactive constituents have been identified through various phytochemical analysis techniques, including chromatography, spectroscopy, and solvent extraction [ref13, ref14, ref18]

Phytochemical Constituents:

Extensive phytochemical screening of various parts of *M. hortensis* reveals a diverse array of bioactive compounds (Table 1) [12-15].

Plant Part	Major Phytochemicals	Biological Significance
Roots	Lapachol, β-sitosterol, poulownin	Antimicrobial, anti-inflammatory [14, 15]
Bark	β-sitosterol, tannins, bitter substances	Anti-asthmatic, antioxidant [16, 17]
Leaves	Hispidulin, rutinoside, beta-carotene	Antioxidant, anti-inflammatory [18, 19]
Flowers	Scutellarein, scutellarein-5-galactoside, hispidulin	Anti-cancer, anti-inflammatory, bronchodilator [20, 21]

IMPORTANT CONSTITUENTS:

- Flavonoids
- Alkaloids
- Tannis
- Phenols
- Glycosides.

CHEMISTRTY OF MILLINGTONIA HORTENSIS

Phytochemical investigations of Millingtonia hortensis have revealed a wide variety of biologically active secondary metabolites. These include flavonoids, glycosides, alkaloids, steroids, and phenolic compounds. Different parts of the plant contain distinct chemical constituents that contribute to its diverse therapeutic effects.

Roots

The roots of Millingtonia hortensis have been reported to contain several important phytoconstituents including:

- Lapachol – a naphthoquinone known for its anti-inflammatory and anti-cancer activities
- β-sitosterol – a phytosterol with anti-inflammatory and cholesterol-lowering properties
- Paulownin – a lignan glycoside with potential antioxidant effects [13, 14]

These compounds collectively contribute to the plant's traditional use in respiratory and microbial disorders.

Bark

Chemical analysis of the bark and heartwood revealed the presence of:

- β-sitosterol
- Bitter principles
- Tannins – polyphenolic compounds known for their astringent and antimicrobial properties [15]

These constituents support the bark's traditional role as a lung tonic and antimicrobial agent.

Leaves

The leaves of Millingtonia hortensis are rich in:

- Hispidulin – a flavonoid with antioxidant, anti-inflammatory, and anti-cancer properties
- Rutinoside – a flavonoid glycoside with vasoprotective and antihypertensive activity
- β-carotene – a precursor of vitamin A, known for its antioxidant activity [17, 18]

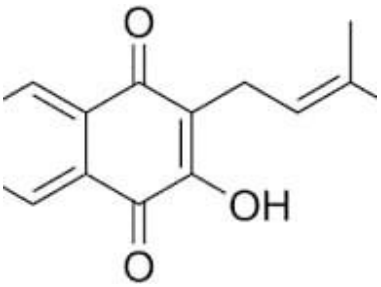
These phytochemicals justify the leaves' use in treating fever, sinusitis, and respiratory conditions.

Flowers

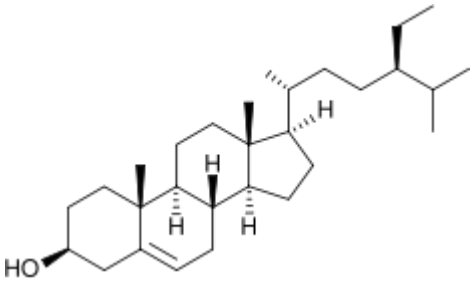
Extensive studies on the flowers have identified the presence of multiple flavonoids and glycosides:

- Scutellarein
- Scutellarein-5-galactoside – a novel glycoside isolated from fresh flowers
- Scutellarein-5-glucuronide
- Hispidulin – also detected in dried flowers via Thin Layer Chromatography (TLC) [20, 24, 25]

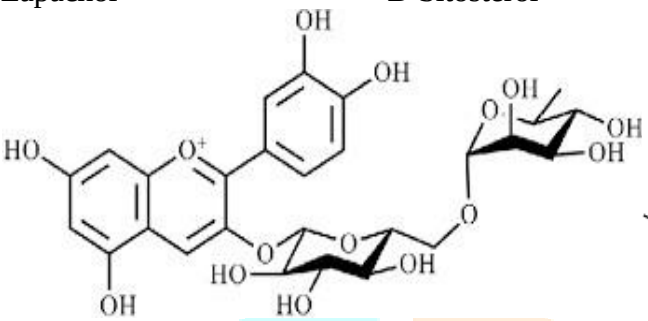
These compounds are attributed with strong antioxidant, antimicrobial, and hepatoprotective activities.



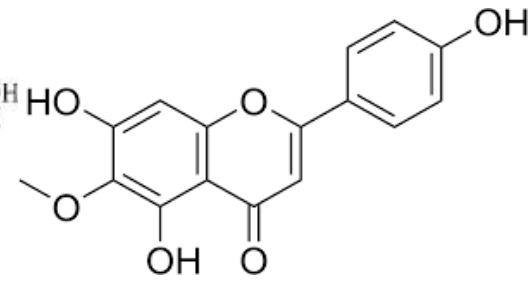
Lapachol



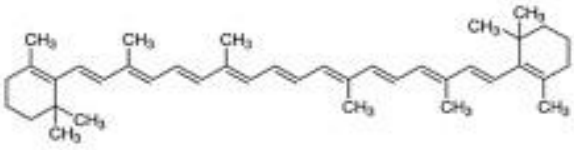
B-Sitosterol



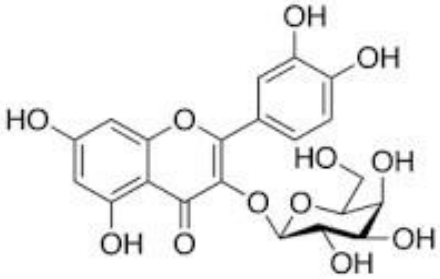
Rutinoside



Hispidulin



b-Carotene



Scutellaria5galactoside

PHARMACOLOGICAL ACTIONS:

Antimicrobial activity:

Millingtonia hortensis exhibits a wide range of pharmacological activities, attributed to its diverse phytochemical constituents. These properties support its traditional uses and offer potential for novel therapeutic applications.

Antimicrobial Activity

The polar extracts of Millingtonia hortensis leaves have demonstrated significant antimicrobial activity against a broad spectrum of microorganisms. In a study involving twenty bacterial strains and two yeast

cultures, aqueous alcohol extracts showed potent activity against all tested microbes, particularly against Gram-negative bacteria such as *Escherichia coli* and *Salmonella typhimurium*, with minimum inhibitory concentration (MIC) values as low as 6.25 µg/ml. The efficacy was comparable to standard antibiotics like gentamycin and antifungal agents like nystatin [ref21].

Antifungal Activity

Different extracts of Millingtonia hortensis have been evaluated for antifungal properties. The methanol extract exhibited stronger antifungal activity than fluconazole against yeast-like fungi, showing a fourfold greater effect against *Candida krusei* at 4 µg/ml minimal inhibitory concentration, and a twofold effect against *Saccharomyces cerevisiae*. However, the activity against *Candida glabrata* was similar to fluconazole [ref22].

Antioxidant Activity

The antioxidant potential of Millingtonia hortensis stem bark extracts has been assessed using various in vitro methods including DPPH radical scavenging, FRAP, DCF/AAPH assay, TRAP, ABTS, superoxide anion scavenging, and nitric oxide assays. The extracts showed a significant antioxidant effect with an IC50 of 29.05 µg/ml in DPPH assay. The total phenolic content was found to be 340 mg/g and total flavonoid content 190 mg/g, which are considered responsible for the observed antioxidant activities. These results suggest that the bark extract can serve as a natural antioxidant for preventing or treating oxidative stress-related diseases [ref23].

Hepatoprotective Activity

The ethanolic extract of Millingtonia hortensis has shown hepatoprotective and antioxidant effects against carbon tetrachloride (CCl4)-induced liver damage in adult Wistar rats. Total phenol and flavonoid contents were quantified, and the extract significantly ameliorated liver enzyme markers and histopathological changes, indicating its protective effect on hepatic tissues [ref24].

Antiasthmatic Activity

The methanol extract of Millingtonia hortensis demonstrated bronchodilatory effects on isolated rat trachea preparations. Fractionation revealed that the chloroform fraction exhibited the most prominent activity. Subsequent chromatographic separation led to the isolation of hispidulin, a flavonoid identified as the active bronchodilating agent. Thin-layer chromatography (TLC) confirmed the presence of hispidulin in the smoke of dried flowers, supporting traditional use in asthma treatment [ref25].

Antihelmintic Activity

Various extracts (petroleum ether, benzene, chloroform, methanol, and aqueous) of Millingtonia hortensis stem bark were tested for antihelmintic activity against adult earthworms. The methanol extract showed dose-dependent antihelmintic activity superior to the reference drug piperazine citrate. Chloroform and benzene extracts at 20 mg/ml also exhibited comparable efficacy to piperazine citrate at 60 mg/ml. The aqueous extract was inactive in this assay [ref26].

Antiproliferative Activity

The aqueous crude extract of Millingtonia hortensis induced apoptosis in RKO colon cancer cells. Partial purification using Sephadex LH-20 chromatography yielded three aqueous fractions, each tested for cytotoxicity via MTT assay. The extract showed promising antiproliferative effects, highlighting its potential as an anticancer agent [ref27].

Mutagenicity and Antimutagenicity

The mutagenic and antimutagenic properties of hispidulin and other flavonoids isolated from Millingtonia hortensis were evaluated using the Salmonella/microsome test (Ames test) with the liquid preincubation method. The compounds exhibited both mutagenic and antimutagenic effects depending on concentration and test conditions, indicating their role in genetic toxicity and protective mechanisms [ref29].

These activities are shown in the following figure-1

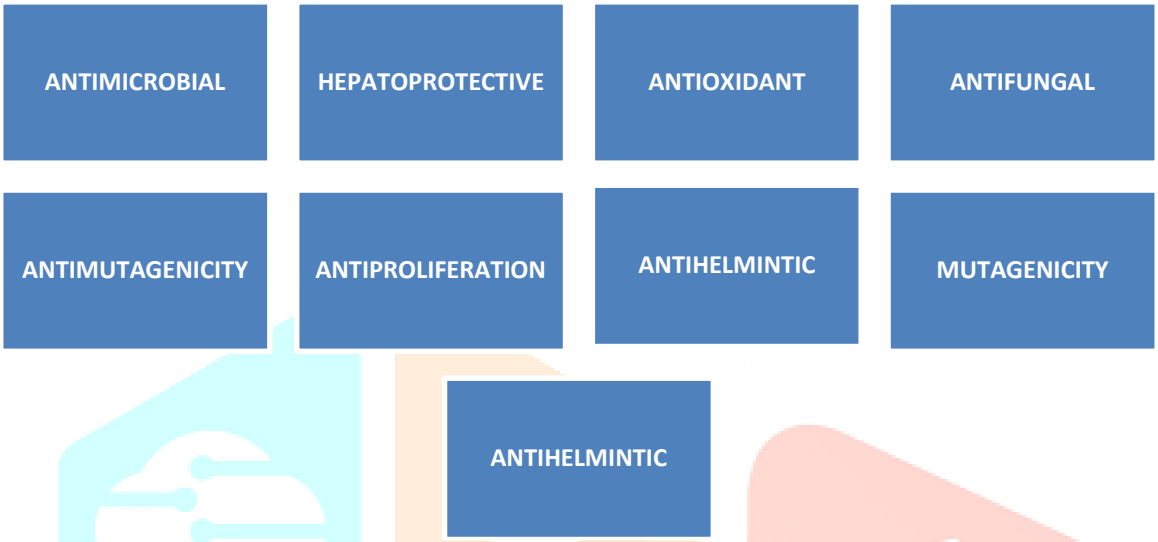


Figure-1

CONCLUSION:

The present study highlights the significant medicinal and pharmacological potential of Millingtonia hortensis, commonly known as the cork tree. Traditionally valued for its ornamental beauty, this plant has emerged as a promising candidate in modern phytotherapy. The investigation into its phytochemical profile revealed the presence of diverse bioactive compounds, including flavonoids, alkaloids, terpenoids, and glycosides, which contribute to its therapeutic efficacy.

Experimental findings demonstrated potent antioxidant and antimicrobial activities, with the isolated compounds showing promising effects comparable to standard references. Additionally, literature reports have substantiated the plant's anti-inflammatory, antiasthmatic, anticonvulsant, hepatoprotective, and anticancer properties, particularly its ability to induce apoptosis in RKO colon cancer cell lines.

This review and experimental work reinforce the traditional uses of Millingtonia hortensis and provide a scientific basis for its continued exploration. However, given the limited scope of current research, further pharmacological and clinical studies are essential to validate and expand on these findings. Investigations into in vivo efficacy, toxicity profiles, and clinical applications will pave the way for its potential integration into modern therapeutic systems.

In conclusion, Millingtonia hortensis holds considerable promise as a multipotent medicinal plant. Its diverse pharmacological activities make it a valuable resource for drug discovery and development, and its continued study will greatly benefit the fields of natural product research, pharmacognosy, and integrative medicine.

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