



TRADITIONAL USES AND PHARMACOLOGICAL EFFECTS OF ACACIA LEUCOPHLOEA: A REVIEW

Pharmacology

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ABSTRACT

Acacia leucophloea, also known as "white bark Acacia," belongs to the family Mimosaceae. It is well-regarded in traditional medicine, particularly within the Ayurveda system, where various parts of the plant are used to treat multiple ailments. This comprehensive review delves into the chemical composition, traditional uses, and pharmacological properties of Acacia leucophloea, with a special focus on its bark.

KEYWORDS

"White babul", "Velvelam", "Distiller's Acacia", "Chenkarigali" and "Mimosaceae"

INTRODUCTION

A source of great economic benefit all over the world is medicinal plants. Some bioactive compounds that create a definite physiological action on the human body are of medicinal value to the plants. Alkaloids, flavonoids, tannins, and phenol compounds are the most essential bioactive compounds for plants. Acacia leucophloea (Roxb.) Willd used in Indian traditional medicine as an astringent, a bitter, a thermogenic, a styptic, a preventive of infections, an anthelmintic, avulnery, a demulcent, an expectorant, an antipyretic, an antidote for snake bites and in the treatment of bronchitis, cough, vomiting, wounds, ulcers, diarrhea, dysentery, internal and external hemorrhages, dental caries, stomatitis, and intermittent fevers and skin diseases. It may be found in several sections of the Indian states like Karnataka, Tamil Nadu & Andhra Pradesh 1-6. PLANT

Description

Acacia leucophloea* is a large, thorny tree known for its distinctive appearance and significant height. Below is a detailed botanical description of the species:

Taxonomical Classification^{7,8}

Kingdom	Plantae
Phylum	Tracheophyta
Class	Equisetopsida C. Agardh
Order	Fabales
Family	Mimosaceae
Genus	Acacia
Species	Acacia leucophloea (Roxb.) Willd.
Common Names	
English	Distiller's Acacia, White babul
Hindi	Safed Kikkar, Nimbar
Bengali	Safed Babul
Kannada	Bellada, Nayibela, Tapala
Malayalam	Chenkarigali
Marathi	Himvar
Sanskrit	Arimedah, Shwetbarhura
Tamil	Velvelam, Sarai
Telugu	Tella Tum.



Figure 1: Acacia Leucoploeswhole Plant

Figure 2: Leaf and Fruit

- Height: Reaches up to 35 meters.
- Trunk Diameter: Can attain a diameter of 100 cm at breast height.
- Trunk and Branches: The trunk is stout, dividing into several large-diameter branches. Open-grown specimens exhibit a characteristic wide umbrella-like crown.
- Bark: The bark is white to yellowish-gray and smooth, exfoliating in long strips. On older trees, the bark becomes black and rough.
- Leaves: Bipinnately compound leaves with 4-13 pairs of pinnae. Each pinna consists of 5-30 pairs of leaflets. Circular glands are found on the rachis below the junction of paired-pinnae. The foliage is feathery green, providing a stark contrast to the light-colored bark.
- Spines: Spines are 2-5 mm long and located at the base of the leaves.
- Flowers: The flowers are light-yellow to cream in color, conspicuous, and found in pedunculate glomerules aggregated in terminal or axillary panicles. They are 5-merous, with corollas measuring 1.2-2 mm long.
- Pods: The pods are yellow, green, or brown in color, flat, and fairly straight, measuring 10-20 cm in length and 5-10 mm in width. Each pod contains 10-20 smooth, oblong, dark brown seeds measuring 6 x 4 mm.

Chemical Composition

- Bark: Rich in tannins, compounds known for their astringent and therapeutic properties. Tannins have been widely studied for their antioxidant, anti-inflammatory, and antimicrobial activities.
- Seeds: Contain fatty oils, which contribute to the plant's nutritional and medicinal value. These oils are often associated with anti-inflammatory and moisturizing properties^{7,8}.

Bioactive Compounds

Medicinal plants owe their therapeutic properties to bioactive compounds that produce specific physiological effects on the human body. The most essential bioactive compounds in plants include:

Alkaloids: Organic compounds with pronounced physiological actions, often used in medicine for their analgesic and anti-malarial properties.

Flavonoids: Known for their antioxidant, anti-inflammatory, and anti-carcinogenic properties.

Tannins: Astringent polyphenolic compounds beneficial for their anti-inflammatory and antimicrobial activities.

Phenolic Compounds: Act as antioxidants and have various therapeutic roles, including anti-inflammatory and anti-carcinogenic effects.

Traditional Uses

Inflammatory Conditions: The bark of Acacia leucophloea is traditionally used to treat bronchial inflammation, a condition marked by the swelling and irritation of the bronchial tubes.

Cough Relief: Due to its anti-inflammatory and soothing properties, the bark is effective in reducing coughing associated with bronchial inflammation.

Skin Disorders: The plant is used to treat biliousness of the skin (a

condition related to liver dysfunction that affects skin color) and leucoderma (a disorder characterized by depigmentation of the skin) [9-13].

Pharmacological Properties

1. Analgesic (Pain-Relieving) Properties

The analgesic properties of *Acacia leucophloea* are attributed to the presence of bioactive compounds that inhibit pain pathways. Effective in managing pain related to inflammation, injuries, and other conditions.

2. Anti-inflammatory Properties

Tannins and other bioactive compounds in the bark inhibit the production of pro-inflammatory cytokines and enzymes, reducing inflammation. Useful in treating conditions like bronchial inflammation, arthritis, and other inflammatory disorders.

3. Anti-viral Properties

Compounds in *Acacia leucophloea* can inhibit viral replication and boost the immune response to fight viral infections. Potential in managing viral infections, although specific studies on its effectiveness against particular viruses are needed.

4. Anti-bacterial Properties

The plant exhibits anti-bacterial activity by disrupting bacterial cell walls and inhibiting bacterial enzymes. Can be used to treat bacterial infections, including skin infections and respiratory tract infections.

Potential Therapeutic Applications

Acacia leucophloea is employed in Indian traditional medicine for a wide range of ailments. Here are some of its notable medicinal uses:

1. Bronchial Inflammation and Cough Relief

The anti-inflammatory and soothing properties of the bark make it effective in reducing bronchial inflammation and associated cough. Traditional use supports its efficacy in managing respiratory conditions.

2. Skin Treatments

The bark's tannins and other compounds are effective in treating biliousness of the skin and leucoderma. These conditions are characterized by changes in skin pigmentation, and *Acacia leucophloea*'s bioactive compounds help restore skin health and appearance.

3. Pain Management

The analgesic properties of the plant can be harnessed to develop natural pain relief therapies, potentially reducing reliance on synthetic painkillers and their associated side effects.

4. Astringent and Styptic

The bark of *Acacia leucophloea* is used as an astringent to contract tissues and stop bleeding, making it effective for wounds and ulcers.

5. Thermogenic and Antipyretic

The plant has properties that help regulate body temperature and reduce fever.

6. Antiseptic and Preventive of Infections

Used to prevent infections, especially in wounds and ulcers, due to its antimicrobial properties.

7. Anthelmintic

Effective against parasitic worms, helping to expel them from the body.

8. Vulnery and Demulcent

Promotes the healing of wounds and soothes irritated or inflamed tissues.

9. Expectorant

Assists in clearing mucus from the airways, making it useful in treating bronchitis and cough.

10. Antidote for Snake Bites

Traditionally used as an antidote for snake bites due to its potential anti-venom properties.

11. Treatment for Gastrointestinal Issues

Used to treat vomiting, diarrhea, dysentery, and internal hemorrhages, showcasing its benefits for gastrointestinal health.

12. Dental and Oral Health

Applied in treating dental caries and stomatitis (inflammation of the mouth and lips).

13. Skin Diseases

Employed in treating various skin diseases, including intermittent fevers and conditions involving skin inflammation.

Pharmacological Studies

1. Antimicrobial activity

Shahid SA et al., 2012 investigated methanolic extract of seeds, flowers, roots, and pods of the plant *Acacia leucophloea* for their antibacterial and antifungal activities using the in-vitro method. The

antibacterial activity was tested against six bacterial species (gram positive and gram-negative) and antifungal activity was tested against six fungal stains. The extract showed potent antibacterial activity against all tested microorganisms using gentamicin and gatifloxacin as standards. The plant extract also showed antifungal activity against all the tested strains compared with Itraconazole and Amphotericin B. The results suggested good antibacterial and antifungal activity of the plant. [14]

2. Antioxidant Activity

Kandhasamy S et al. (2013) evaluated the antioxidant activity of the bark of *Acacia leucophloea*, focusing on acetone and methanol extracts. Acetone Extract Showed substantial antioxidant activity across all assays. Methanol Extract Also demonstrated significant antioxidant properties, although the study primarily highlighted the acetone extract. The bark extracts of *Acacia leucophloea* possess potent antioxidant activities, making them valuable for counteracting oxidative stress-related damage [15].

3. Anti-platelet Activity

Study by Imran I et al., 2012 the anti-platelet activity of methanolic bark extract of *Acacia leucophloea* tested against ADP-induced human platelet aggregation. Methanolic extract showed significant anti-platelet activity. The bark extract has potential as an anti-platelet agent [16].

4. Gastrointestinal and Respiratory Activities

Study by Imran I et al., 2011 *Methanolic bark extract exhibited dose-dependent spasmolytic and bronchodilator activities. The extract possesses spasmolytic and bronchodilator properties [17].

5. Wound Healing Activity

Study by Sembian S et al., 2012 investigated the wound healing activity of *Acacia leucophloea* bark extracts. The ethanolic extract ointment is effective in wound healing [18].

6. Anti-diabetic & Anti-hyperlipidemic Activity

Madhavi M et al., 2014 investigated anti-diabetic and anti-hyperlipidemic potential in streptozotocin-nicotinamide induced type II diabetes in rats. Extracts show Significant reduction in glucose levels, lipid profile, and body weight [19].

7. Antipyretic Activity

Gupta R et al., 2021 studied the antipyretic activity of methanolic extract using the yeast-induced pyrexia method. The methanolic extract has Significant reduction in body temperature for up to 2 hours post-treatment [20].

8. Antibacterial Activity:

Kasi Murugan et al., 2014 - Demonstrated enhanced antibacterial activity of green-synthesized AgNPs via *A. leucophloea* extracts against several pathogenic bacteria [21].

9. Other Studies and Findings

Arthanarieswaran VP et al., 2015 - Studied physicochemical properties of fibers isolated from the bark, revealing significant thermal and mechanical properties [22].

10. Chemical Composition and Antioxidant Capacity:

Zia-Ul-Haq M et al., 2013 - Analyzed the chemical composition and antioxidant capability of various plant parts, highlighting significant antioxidant potential [23].

11. Proximate Composition and Nutritional Analysis:

Vijayakumari K et al., 1994 - Analyzed seed composition, revealing high protein, lipid, fiber, and essential minerals content [24].

12. Metabolite Analysis:

Bhawana Sharma et al., 2019 - HPLC-ESI-QTOF-MS analysis identified specific compounds and up-regulated metabolites in interaction studies [25].

13. Structure Revision of Diterpenoids:

María del Carmen Apreda Rojas et al., 2001 - Revised the structures of leucophleol and leucophleoxol, supporting isopimarane-type derivatives [26].

CONCLUSION

Acacia leucophloea has significant medicinal potential, validated by

numerous pharmacognostic studies. Establishing comprehensive pharmacognostic standards will enhance the authenticity and reliability of its medicinal applications. These findings will support further research and development in pharmacology, contributing to the broader acceptance and utilization of *Acacia leucophloea* in modern medicine.

Acknowledgements

The authors thank Dr. M.Kuamr, Principal, Vinayaka Mission's college of Pharmacy, Vinayaka Mission's Research Foundation(DU), Salem, Tamilnadu, India for him invaluable guidance's and encouragements.

Founding Information

Authors not received any kind of funding for this review process.

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