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"Ethnobotanical Insights And Bioactive Compounds Of *Plumeria Alba* Linn.: A Medicinal Treasure"

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ABSTRACT:

Plumeria alba, a small laticiferous tree or shrub native to tropical America, is commonly referred to as White Champa. It is primarily cultivated for its ornamental and fragrant flowers, which also hold significant medicinal value. The leaves, which are lanceolate to oblanceolate, and the white, aromatic flowers arranged in corymbose fascicles, contribute to its aesthetic appeal. Additionally, its fruit is edible.

Phytochemical evaluations of the leaves and stems have revealed their use in traditional medicine for treating various ailments. The plant's latex, known for its potent and sometimes corrosive nature, is applied externally to treat ulcers, herpes, and scabies. Its seeds are recognized for their hemostatic properties, while the bark, when bruised, is used as a plaster for hard tumors. Furthermore, other parts of the plant have been employed as purgatives, cardiotonics, diuretics, and hypotensives.

The medicinal significance of *Plumeria alba* has been well-documented in classical Ayurvedic texts such as the Charaka Samhita and Sushruta Samhita. For centuries, plant-based remedies have been an integral part of traditional medicine systems in India, offering treatments for a wide array of health conditions. This reliance on herbal medicine continues to gain global recognition as a natural and effective alternative healthcare approach.

INTRODUCTION:

Plumeria, commonly referred to as frangipani, belongs to the genus of flowering plants in the dogbane family, **Apocynaceae**. It primarily consists of deciduous shrubs and small trees. The species are native to Central America, Mexico, the Caribbean, and regions of South America, extending as far south as Brazil, but they are also widely cultivated in tropical and subtropical areas worldwide (Ganjewala & Gupta, 2013).

Plumeria alba, a small laticiferous tree or shrub originating from tropical America, typically grows up to 4.5 meters in height and is often planted in gardens for its ornamental value and fragrant flowers. The leaves are lanceolate to oblanceolate, and the flowers are white, aromatic, and arranged in corymbose clusters (Kirtikar & Basu, 2006). The fruit is edible, while the plant's latex is applied externally for treating ulcers, herpes, and scabies. Its seeds exhibit hemostatic properties, and the bark, when bruised, is used as a plaster for treating hard tumors (Chopra et al., 1956).

Additionally, the plant has been traditionally employed as a purgative, cardiotonic, diuretic, and hypotensive agent (Nadkarni, 1954). Methanolic extracts of **Plumeria alba** have demonstrated antimicrobial activity against pathogens such as **Bacillus anthracis** and **Pseudomonas aeruginosa** (Gupta et al., 2009).

Phytochemical investigations have identified several bioactive compounds, including **amyirin acetate**, a mixture of **amyrins**, **β -sitosterol**, **scopotin**, and the iridoids **isoplumericin**, **plumieride**, **plumieride coumerate**, and **plumieride coumerate glucoside** (Ahmed et al., 2010; Rastogi & Mehrotra, 1991). These findings highlight its therapeutic potential, making **Plumeria alba** an essential plant in traditional and modern medicine systems.

Geography:

Frangipani, commonly known as Plumeria, is native to tropical regions but thrives in any frost-free environment. It is well-adapted to warm climates and can even withstand periods of drought and moderate salt exposure, making it suitable for coastal areas. The tree is characterized by its thick, fleshy branches and stems, often forming a distinctive V-shaped structure. Its bark is tender, and when cut, it releases a milky white sap that may cause skin irritation. The flowers are large, funnel-shaped, and typically white with a yellow center. They are highly fragrant, making the plant popular in ornamental gardening. However, the flowers, once fallen, can create litter around the base of the tree. Despite this, Plumeria remains a favored choice for landscaping due to its drought tolerance, aesthetic appeal, and pleasant aroma. **Frangipani** is widely admired for its intensely fragrant, spiral-shaped blooms, which appear at the tips of branches from June through November. The tree has a distinctive and somewhat unusual appearance, featuring coarse, deciduous leaves that can grow up to 20 inches long. These leaves are clustered primarily at the ends of the thick, grey-green branches, giving the tree a striking look.

Growing Season and Type

1. **Planting Conditions** – White **Plumeria** thrives in fertile, well-drained soil and requires full sunlight during the summer. It prefers a soil pH ranging between 6.1 and 7.5. Although it can grow in loam, sand, or clay soils, planting in nutrient-rich soil yields the best results.
2. **Watering Requirements** – Young **Plumeria** plants should be watered regularly, especially in the absence of rainfall. Providing approximately one inch of water per week throughout the growing season is sufficient. However, avoid overwatering, as it can lead to root rot.
3. **Fertilization** – Feed **Plumeria** twice a month during its active growth phase. A water-soluble fertilizer with a high phosphorus content is recommended to support healthy growth and abundant flowering.

Phytochemical Constituents

Part of Plant	Phytochemical Constituents	References
Bark	Alkaloids, carbohydrates, flavonoids, phenolic compounds, tannins	Ahmed et al., 2010
Whole Plant	Amyrin acetate, amyrins, β -sitosterol, scopotetin, isoplumericin, plumieride, plumieridecoumerate, plumieridecoumerate glucoside	Rastogi & Mehrotra, 1991
Flowers	Geraniol, citronellol, farnesol, phenyl ethyl alcohol, linalool, quercetin, kaempferol	Gupta et al., 2009; Ahmed et al., 2010

Bioactive Compounds of *Plumeria alba*

Compound	Properties	Uses	Reference
Alkaloids	Antimicrobial, anti-inflammatory, analgesic	Bacterial and fungal infections	Goyal et al., 2012 [1]
Flavonoids	Antioxidant, anti-inflammatory, anti-cancer	Flowers: Quercetin, Kaempferol	Ahmed et al., 2010 [2]; Siddiqui et al., 1994 [3]
Phenolic Compounds	Antioxidant, free radical scavenging	Skin diseases, wound healing	Rastogi & Mehrotra, 1991 [4]
Tannins	Astringent, antimicrobial	Ulcer treatment, healing wounds	Chopra et al., 1956 [5]
Iridoid Glycosides	Anti-inflammatory, cytotoxic, antimicrobial	Plumieride, Plumieridecoumerate, Plumieridecoumerate glucoside	Nargis et al., 1993 [6]
Triterpenoids	Anti-inflammatory, hepatoprotective, analgesic	Amyrin acetate, mixture of Amyrins	Rengaswami & Venkatarao, 1960 [7]
Sterols	Anti-inflammatory, anticancer	β -sitosterol	Asolkar et al., 1992 [8]
Essential Oils	Antimicrobial, aromatic	Flowers: Geraniol, Citronellol, Farnesol, Phenyl ethyl alcohol, Linalool	Zahid et al., 2010 [9]
Resinic Acid	Wound-healing, antiseptic	Bark	Gilman & Watson, 1994 [10]
Cytotoxic Iridoids	Anticancer, antimicrobial, antiviral	Fulvoplumierin, Plumericin, Allamcin	Chowdhur et al., 2010 [11]

Pharmacological Activities**1. Antimicrobial Activity**

Plumeria alba has demonstrated significant **antimicrobial properties**, showing broad-spectrum activity comparable to common antibiotics. It is particularly effective against **Escherichia coli**, a common uro-gastro pathogenic bacterium often resistant to synthetic drugs. The plant's extracts

present a promising source for the development of new, non-toxic antimicrobial compounds and natural antibiotic agents, especially against **E. coli** (Gupta et al., 2009).

Bacterial Strains	Antibacterial Activity
Escherichia coli	
Proteus vulgaris	High
Staphylococcus aureus	
Klebsiella pneumoniae	
Pseudomonas aeruginosa	
Staphylococcus saprophyticus	High
Enterococcus faecalis	
Serratia marcescens	High

2. Larvicidal Activity

The **leaf extract** of *P. alba* has shown potent **larvicidal activity** against **Aedes aegypti** mosquitoes, a primary vector of dengue and yellow fever. The lethal concentration (LC₅₀) was recorded as **218.8 ppm**, suggesting its potential use as a botanical insecticide for mosquito control (Sharma & Saxena, 2011).

3. Hepatoprotective Activity

The **hepatoprotective potential** of *P. alba* methanolic extract was tested against **paracetamol-induced hepatotoxicity** in **Wistar rats**. Doses of **100, 200, and 400 mg/kg** were administered to evaluate its protective effect.

Uses of *Plumeria alba*

Different parts of *Plumeria alba* have been traditionally used to treat a variety of ailments, including **malaria, leprosy, rheumatism, and abdominal tumors**. The plant's medicinal properties have been well-documented in traditional medicine systems.

1. **Milky Sap** – The **milky latex** extracted from the stem and leaves is applied externally to treat **skin diseases** such as **herpes, scabies, and ulcers** (Chopra et al., 1956).
2. **Bark** – The **bark** is used in a **bruised form** as a **plaster** over **hard tumors**, providing relief and promoting healing (Kirtikar & Basu, 2006).
3. **Seeds** – The **seeds** are valued for their **hemostatic properties**, helping to stop bleeding and support wound healing (Ahmed et al., 2010).
4. **Latex** – The **latex** of *P. alba* is known for its use as a **purgative, cardiotonic, diuretic, and hypotensive agent**, showcasing its diverse pharmacological potential (Gupta et al., 2009).

In addition, *P. alba* is widely used to treat **ulcers**, **herpes**, and **scabies**, with the bark and latex playing significant roles in addressing **hard tumors** and **skin infections**.

Conclusion

Plumeria alba Linn. has been scientifically recognized for its **medicinal properties** and **therapeutic potential**. Various parts of the plant, including the **leaves**, **bark**, **flowers**, **latex**, and **seeds**, have demonstrated **pharmacological activities**, such as **antimicrobial**, **anti-arthritic**, **antifungal**, **hepatoprotective**, and **larvicidal effects**.

Rich in **bioactive compounds** like **alkaloids**, **flavonoids**, **phenolic compounds**, **iridoid glycosides**, and **terpenoids**, this plant has been widely utilized in **traditional medicine** to treat conditions such as **malaria**, **leprosy**, **rheumatism**, **tumors**, **skin diseases**, and **ulcers**.

The extensive medicinal value of *P. alba* highlights its importance as a **natural remedy** and supports further **research** to explore its **pharmacological applications** and potential contributions to **modern medicine**.

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