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Review on *Plumeria pudica*: Phytochemical and pharmacological insights

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Abstract
Medicinal plants have always played a key role in traditional healthcare systems, and modern research supports their healing properties. *Plumeria pudica* (Apocynaceae) is an ornamental plant found in tropical regions. It has captured scientific interest because of its varied medicinal potential. Almost every part of the plant, especially the leaves and latex, has been traditionally used to treat various conditions. This review looks at the phytochemical composition and therapeutic effects of *P. pudica*, focusing on its antimicrobial, antidiarrheal, antioxidant, anti-inflammatory, anti-ulcerative colitis, and anti-Alzheimer's properties.

Phytochemical analyses show that isopropyl alcohol and hydroalcoholic leaf extracts contain many bioactive compounds, such as phenols, flavonoids, proteins, carbohydrates, iridoid glycosides, triterpenoids, sterols, tannins, and alkaloids, as confirmed by LC–MS QTOF studies. The isopropyl alcohol extract demonstrated strong antioxidant activity in DPPH and reducing power tests. Aqueous and hydroalcoholic extracts showed significant antimicrobial effects, especially against *Klebsiella pneumoniae*. The water-soluble protein fraction from the latex (LPPp) had notable antidiarrheal effects. It reduced intestinal secretion, motility, and inflammation, while also providing protection against acetic acid-induced ulcerative colitis through anti-inflammatory and antioxidant actions. Methanolic leaf extracts exhibited strong anti-inflammatory effects in both lab and live models and showed acetylcholinesterase inhibition. This suggests potential neuroprotective benefits related to Alzheimer's disease. Overall, these findings present *Plumeria pudica* as a valuable natural source of bioactive compounds with various therapeutic uses, supporting its traditional applications and potential for development into plant-based medicines.

Keywords: *Plumeria pudica,* Apocynaceae, phytochemistry, medicinal plants, pharmacological activities

Introduction

Nowadays, a lot of study is being done on various plant species and their therapeutic principles, which is revaluing traditional medicine worldwide [1]. The therapeutic use of plant-based products dates back more than 5,000 years in ancient Indian, Egyptian, Chinese, Greek, and Roman civilizations. These plants were used to treat diseases and restore body systems. Medicinal plant therapy is rooted in long-standing empirical observations, though some claimed benefits were later found to be incorrect. In the Western world, written documentation began in 78 A.D. with Dioscorides' *De Materia Medica*. This work described thousands of medicinal plants and their uses. Although the term "Materia medica" is no longer widely used, natural substances remain important in medicine. Many modern drugs still share therapeutic effects with traditional plant-based remedies [2]. The treatment of disease with plant extracts is called herbalism, although more recently the term "phytotherapy" has come into vogue [3].

The plant *plumeria pudica* possess the various medicinal activity, nearly every component of this plant is employed to address a diverse range of health issues. *Plumeria pudica* Apocynaceae plant is well-known for producing a lot of latex [4]. Plumeria pudica has a long blooming season and is easy to grow. Flowers don't smell. The dark green leaves of Plumeria pudica have a distinctive fiddle or spoon shape (long and narrow, widening out as big lobes towards the tip, like the shape of a soup spoon), with a very short petiole that can reach a length of 13 inches. The white, salver-shaped flowers have five overlapping petals and a yellow throat that can reach a diameter of three and a half inches. They are placed on terminal cymes. The plant is widely distributed in northeastern Brazil, where the impoverished people describe using its latex to alleviate dental discomfort and skin conditions. Numerous studies have shown the pharmacological characteristics of various plant parts from the Plumeria genera in the literature [5].

Bridal bouquet, or Plumeria pudica (Apocynaceae), is a flowering ornamental plant that is related to P. rubra, the common frangipani. P. pudica is a popular landscape plant in south Florida and the Caribbean due to its lengthy flowering period and eye-catching white blossoms. It is native to Columbia, Panama, and Venezuela [6]. Plumeria species have also been investigated for isolation of irridoids and triterpenoids, which exhibited algicidal, antibacterial and cytotoxic activities. The first physiologically active substances to be isolated from Plumeria species were iridoid glycosides. Other medicinally active components, such as sterols, polysaccharides, tannins, triterpenoids, and alkaloids, were later discovered to be present in the latex and oil of several of these species. The plants are well renowned for their religious significance, aesthetic value, and enormous potential as therapeutic agents to treat infections, digestive disorders, anti-inflammatory and antipyretic activity, anti-tumor potential, antioxidant qualities, etc [7].

Synonym

Bridal bouquet, Wild Plumeria, White frangipani, Fiddle leaf.

Taxonomical classification [8]

Kingdom	Plantae
Sub kingdom	Tracheophytes
Class	Dicotyledons
Subclass	Asterids
Order	Gentianales
Family	Apocynaceae
Genus	Plumeria
Species	Pudica

Vernacular Names [9]

Languages	**Names**
Kannada	Shweta Champa
Malayalam	Vellachampakam
Hindi	Naag Champa
Tamil	Naavilla arali
Indonesian/Malaysian	Kemboja
French	Bouquet de mariée, frangipani pudique

Distribution [6, 10]

Plumeria pudica is popular landscape plant in south Florida and the Caribbean due to its lengthy flowering period and eye-catching white blossoms. It is native to Columbia, Panama, and Venezuela.

Fig 1: *Plumeria pudica* Plant

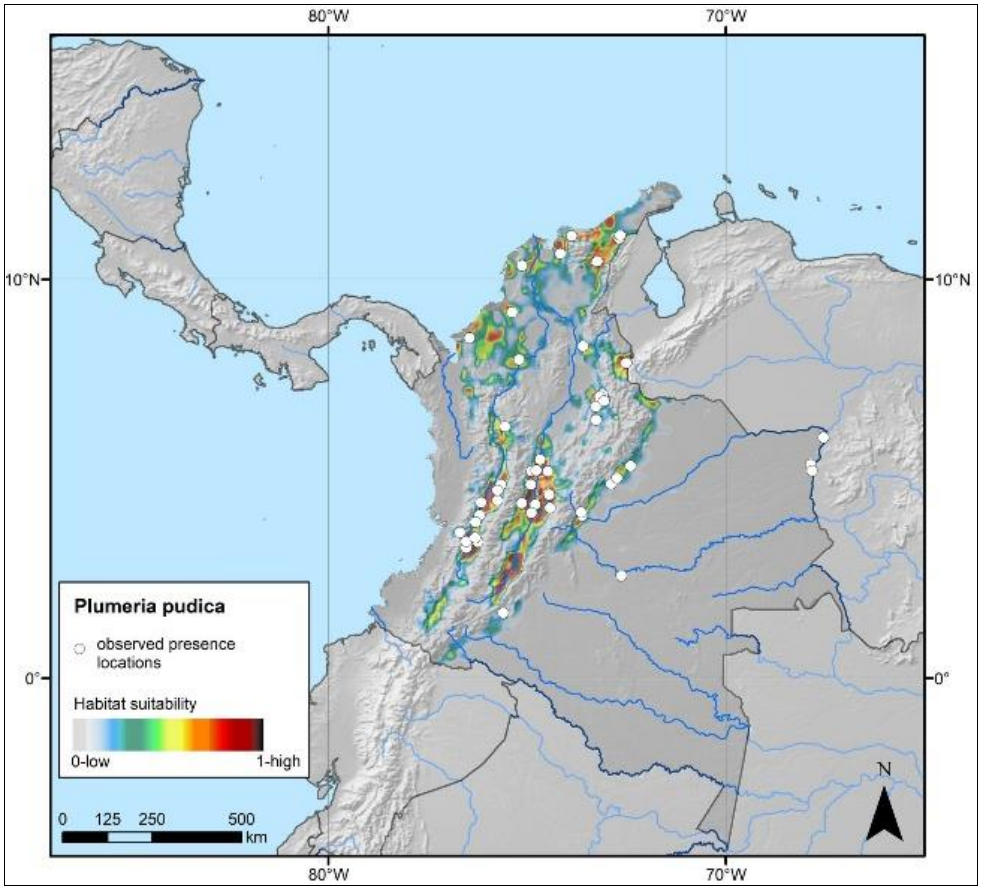

Fig 3: Distribution of plant

Phytochemicals [11]

Plumeria pudica plant extract has been investigated for various phytochemical constituents and study reveals that the methanolic leaf extract of *P. pudica* possess alkaloids, carbohydrates, glycosides, oils and fats, cardiac glycosides, steroids, tannins, phenols, flavonoids, terpenoids and proteins present in it.

Uses

Plumeria pudica widely used as a medicinal product to heal infections and digestive diseases. It has anti-inflammatory, anti-pyretic, anti-tumor, antimicrobial, diuretic, cytotoxic, anti-allergic, ascites, diuretic, anti-ulcer, and antioxidant properties.

Pharmacological activity

Anti-bacterial activity [12]

This study evaluated the antimicrobial properties of *Plumeria pudica* leaf extracts. Qualitative and quantitative analyses revealed that isopropyl alcohol (IPA) and hydroalcoholic extracts possessed superior phytochemical content, with IPA showing the highest levels of phenols, flavonoids, carbohydrates, and proteins. LC–MS QTOF analysis confirmed the presence of pharmacologically important compounds. The IPA extract demonstrated strong antioxidant activity in DPPH and reducing power assays, while aqueous and hydroalcoholic extracts exhibited notable antimicrobial activity, particularly against *Klebsiella pneumoniae*. Overall, *P. pudica* leaves show significant potential as a natural source of bioactive compounds for therapeutic applications.

Anti-diarrheal activity [13]

The water-soluble protein fraction obtained from *Plumeria pudica* (LPPp) latex has previously been demonstrated to have anti-inflammatory and antinociceptive effects. Different doses of LPPp (10, 20 or 40 mg/kg) significantly inhibited the percentage of diarrheal stools induced by castor oil. This event was followed by significant reduction of both intestinal fluid accumulation and intestinal transit. LPPp (40 mg/kg) also inhibited the average volume of intestinal fluid induced by PGE2 and prevented intestinal fluid secretion accumulation and chloride ion concentration induced by cholera toxin. Our data suggest that the antidiarrheal effect of LPPp is due to its protein content and is probably associated with its anti-inflammatory properties.

Anti-oxidant activity [14]

The antioxidant potential of *Plumeria pudica* leaf extracts was determined using the reducing power assay and the DPPH (2,2-diphenyl-1-picrylhydrazyl) assay. Among the extracts, the IPA extract showed the highest DPPH scavenging activity with 66.85% inhibition and an IC_{50} value of 33.54 µg/mL. The IPA extract also exhibited the highest reducing power with an absorbance value of 1.5. These results signify robust antioxidant activity in the leaf extracts of *P. pudica*.

Anti-inflammatory activity [15]

The leaf extracts of *Plumeria pudica* were evaluated for their anti-inflammatory potential using *in vitro* inhibition of albumin denaturation and anti-proteinase assays. All extracts showed inhibition of albumin denaturation at different concentrations, with the methanolic extract exhibiting the highest inhibition (64.36%) at 500 µg/mL. The methanolic extract also demonstrated the greatest anti-proteinase activity, inhibiting 51.37% at 500 µg/mL. Based on its superior *in vitro* activity, the methanolic extract was selected for *in vivo* studies. The methanolic leaf extract reduced inflammation in a dose-dependent manner, showing maximum edema inhibition of 28.78% at 100 mg/kg and 50.4% at 200 mg/kg after 4 hours.

Ulcer colitis activity [16]

In this study, the water-soluble protein fraction of *Plumeria pudica* (LPPp) was evaluated for its protective effect against inflammatory ulcerative colitis induced by acetic acid in mice. LPPp administered at 10, 20, and 40 mg/kg significantly reduced colonic wet weight and macroscopic and microscopic lesion scores. Treatment with LPPp (40 mg/kg) decreased myeloperoxidase activity, indicating reduced inflammatory cell infiltration. LPPp also inhibited oxidative stress by reducing glutathione consumption, malondialdehyde concentration, and superoxide dismutase activity. Additionally, LPPp lowered IL-1β levels, contributing to the reduction of colon inflammation. These findings suggest that LPPp protects against ulcerative colitis through anti-inflammatory and antioxidant mechanisms.

Alzheimer's activity [17]

The enzyme AChE plays a major role in the dissociation of the neurotransmitter acetylcholine (Ach) in to acetic acid and choline and there by affecting the nerve transmission. One of the current scenario for the treatment of Alzheimer disease is to inhibit the activity of AChE, which decrease the degree of neuro-degeneration. AChE inhibitors are found to be naturally present in the plants. Hence the methanolic extract of the leaves of *Plumeria pudica* was screened for AChE inhibitors for the brain homogenate of the zebrafish (*Danio rerio*). Through the titri-metric analysis of the AChE in in-vitro and *In vivo* conditions the activity was recorded. We have found that the methanolic extract of *Plumeria pudica* reduces the activity of AChE from 18% – 15.8%.

Conclusion

In summary, *Plumeria pudica* exhibits diverse therapeutic potential as a medicinal plant. Phytochemical analyses reveal the presence of numerous bioactive constituents, highlighting its promising pharmacological applications, including antidiarrheal, antioxidant, anti–ulcerative colitis, anti-inflammatory, anti-Alzheimer, and antibacterial activities. The medicinal use of its fruits, bark, leaves, and seeds underscores the need for further scientific investigation to elucidate their pharmaceutical significance and support the development of effective treatments for a wide range of diseases.

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