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A review of the pharmacological evaluation of *Premna Serratifolia*

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Abstract
Premna Serratifolia is a medicinal shrub most widely used in traditional remedies across India and Southeast Asia. The generic name is derived from the Greek word "premnon" meaning tree stump, referring to the often short and twisted tree trunks of i. In the Indian traditional Ayurvedic system of medicine the plant is a highly valuable ingredient of Dashamoolam. The goal of this review is to assess the current progress of research on *Premna Serratifolia*. This review focuses on bioactive compounds, *in vitro* activities *Premna Serratifolia*. The most frequent used solvents are water, methanol and ethanol. The information on bioactive compounds is mainly from methnol and ethanol extract. Various bioactive compounds like oleanolic acid, diosmin, and terpenoids. These findings provide strong support for the traditional use of *Premna Serratifolia* and highlight its potential as a source of natural therapeutic agents. Nonetheless, further in-depth pharmacological investigations and clinical validations are essential to fully establish its efficacy, safety, and mechanisms of action.

Keywords: *Premna Serratifolia*, premnon

Introduction
Premna seratifolia is commonly known as Arni or Agnimantha, belongs to the family Lamiaceae. It is a small tree or shrub widely distributed in India, south east Asia, and other tropical regions [1]. Traditionally it is used in various medicinal systems including Ayurveda, Siddha and Unani especially in formulations like Dashamoola which is used for treating inflammatory and respiratory diseases [2]. Various parts of *Premna Serratifolia* have health benefits .It has anti- parasitic activity against Leishmania donovani, antiarthritic, antioxidant and antitumor activity [3]. *In vitro* pharmacological evaluation is an essential preliminary approach in drug discovery, enabling researchers to identify bio active compounds and understand their mechanism of action under controlled experimental conditions [4]. It holds a prominent place in various classical formulations, particularly those aimed at treating fevers, inflammatory disorders, and conditions involving the respiratory and digestive systems. In folk medicine, different parts of this plants especially the roots, leaves, bark, and flowers have been used to manage a wide range of ailments, including asthma, diarrhea, dyspepsia, rheumatism, and wound healing [5].
In vitro assays are particularly useful in the early stages of pharmacological screening as they provide a controlled environment to analyze the biological effects of plant extracts and isolated compounds on specific cell types, enzymes, or pathogens [6]. These methods are essential for identifying potential therapeutic agents before moving on to *in vivo* studies and clinical evaluations. In the case of *Premna Serratifolia*, such evaluations have not only confirmed some of its traditional uses but have also revealed new pharmacological possibilities that merit further exploration [7]. Despite the growing body of literature, a consolidated understanding of the *in vitro* pharmacological profile of *Premna Serratifolia* is still emerging. This necessitates comprehensive reviews and systematic studies to evaluate its full therapeutic potential [8]. The current exploration seeks to compile and analyze existing *in vitro* data on the plant, highlighting its medicinal significance and identifying gaps for future research.

Fig1: *Premna Serratifolia*

Major Chemical Constituents

1. Flavonoids

The plant is rich in flavonoids such as luteolin, apigenin, kaempferol, and quercetin, which are widely known for their antioxidant, anti-inflammatory, and cell-protective functions [9].

2. Phenolic Compounds

Compounds like gallic acid, caffeic acid, and ferulic acid have been identified, which play a critical role in neutralizing free radicals and exert antimicrobial effects [10].

3. Alkaloids

Various alkaloids, including indole-type structures, have been reported, contributing to the plant's analgesic, antispasmodic, and neuroactive properties [11].

4. Terpenoids and Steroidal Compounds

Components such as β-sitosterol, lupeol, and oleanolic acid are present and are associated with anti-inflammatory, anticancer, and liver-protective properties [12].

5. Iridoid Glycosides

Unique iridoid glycosides such as premnacatalinol and premnacatalin have been found in different plant parts, which may contribute to the antipyretic and anti-inflammatory activities [13].

6. Volatile Oils (Essential Oils)

Leaf and bark essential oils contain active components like eugenol, linalool, and caryophyllene oxide, which exhibit potent antibacterial and antifungal activity [14].

7. Saponins

Saponins have also been isolated and are believed to contribute to the plant's immune- modulating and antioxidant potential [15].

Macroscopic and Microscopic Features of *Premna Serratifolia*

Macroscopic characters

Aromatic, thick, shiny, dark green ventral, light green dorsal, petiole, 1.9 - 3.5cm, puberulent; lamina [16] oblong to broadly ovate, 10 - 13 x 5.7 - 7.5cm, glabrous or pubescent only along veins, base broadly cuneate, rounded or truncate, margin entire, slightly undulate or crenate, apex acute to rarely acuminate or obtuse.

Microscopic characters

The petiole in transverse sectional view cubical in shape with the distinct concave adaxial surface. The epidermis is a single layer, cubical shaped cells with trichomes. Next to the epidermis 4 - 5 layers of collenchymatous cells present. A large dorsal vascular bundle and two small ventral vascular bundles are present. Thus, the arrangement is expressed as 1 + 2. The dorsal vascular bundle consists of a central main bowl-shaped xylem and phloem. Patches of sclerenchyma cells covered the phloem. The ventral vascular bundles are somewhat elongate of circular. The center region of ground tissue is made up of large parenchymatous cells. Calcium oxalate crystals are not evident.

Lamina

The midrib has convex in the adaxial surface, a single layer epidermis having cuboid shape cells with a thick cuticle. Three to four layers of collenchyma cells followed by epidermis. A bowl- shaped large vascular bundle in the dorsal side and small circular shaped vascular bundle in ventral side consisting xylem and phloem. Patches of sclerenchyma surrounded the phloem region. The center ground tissue is made up of parenchymatous cells [17].

In lamina, the upper epidermis has large, cuboid or rectangle shaped cells and the lower epidermis has comparatively small cuboid-shaped cells. Both epidermises has thick cuticle. Next to the upper epidermis, the narrowly cylindrical single layer of palisade parenchyma and spherical spongy parenchyma cells forming a network. Vascular bundles are of various sizes, stomata diacytic type and hypostomatic. Peltate trichomes gland present in the lower epidermis [18].

Pharmacological and biological activity

1. Antioxidant Activity

The plant exhibits strong antioxidant properties, primarily due to its rich content of phenolic compounds and flavonoids. *In vitro* assays such as DPPH, ABTS, and FRAP have confirmed the free radical scavenging ability of methanolic and ethanolic extracts of the leaves and roots. These antioxidant effects help in reducing oxidative stress, which is a contributing factor in chronic conditions like cancer, neurodegenerative diseases, and aging [19].

2. Anti-inflammatory Activity

Various parts of the plant, especially the leaf extract, have been shown to inhibit inflammation through the suppression of pro-inflammatory markers. *In vitro* studies indicate that the plant extracts can inhibit enzymes like cyclooxygenase (COX) and lipoxygenase (LOX), as well as reduce the production of cytokines such as TNF-α and IL-6, which are involved in inflammatory responses. This supports the traditional use of *Premna Serratifolia* in treating arthritis, fever, and other inflammatory disorders [20].

3. Antimicrobial Properties

The plant possesses potent antimicrobial effects against a variety of pathogenic bacteria and fungi. Extracts have shown efficacy against Staphylococcus aureus, Escherichia coli, Bacillus subtilis, and Candida albicans in *in vitro* antimicrobial tests like agar diffusion and broth dilution methods. The presence of bioactive alkaloids, terpenoids, and iridoid glycosides may disrupt microbial cell walls or interfere with microbial enzymes, leading to cell death [21].

4. Neuroprotective Activity

Initial studies suggest the plant's potential in protecting nerve cells from oxidative damage. The antioxidant-rich constituents may help inhibit neurotoxicity and promote neuronal health. This opens a potential therapeutic application for *Premna Serratifolia* in neurodegenerative diseases like Alzheimer's and Parkinson's [22].

5. Cytotoxic and Anticancer Activity

Certain *in vitro* studies have reported cytotoxic effects of *Premna Serratifolia* extracts against human cancer cell lines such as MCF-7 (breast cancer) and HepG2 (liver cancer). The mechanism appears to involve the induction of apoptosis, inhibition of cell proliferation, and disruption of mitochondrial function. These effects are primarily attributed to iridoid glycosides and phenolic compounds [23].

6. Antidiabetic Activity

The leaf and root extracts have shown the ability to inhibit α-amylase and α-glucosidase enzymes, which are responsible for carbohydrate digestion [24]. By slowing down glucose absorption in the intestine, these extracts help in controlling postprandial blood sugar levels. These properties make *Premna Serratifolia* a promising candidate for the management of type 2 diabetes mellitus.

7. Hepatoprotective Activity

Experimental data suggests that *Premna Serratifolia* extracts offer protection to liver cells against damage induced by toxins like carbon tetrachloride (CCl_4) and paracetamol. The protective effect is likely due to its antioxidant properties and the ability to stabilize hepatic enzymes such as AST, ALT, and ALP [25].

Conclusion

The comprehensive analysis of *Premna Serratifolia* through *in vitro* pharmacological studies highlights its immense therapeutic potential, which aligns closely with its widespread traditional usage across various systems of medicine, especially Ayurveda, Siddha, and Unani. The plant is a rich reservoir of pharmacologically active compounds, including flavonoids, phenolic acids, alkaloids, terpenoids, iridoid glycosides, and essential oils, each contributing to its diverse bioactivities. Evidence from *in vitro* studies demonstrates that extracts of *Premna Serratifolia*, particularly those derived using methanol and ethanol, exhibit significant biological effects. These include potent antioxidant activity that combats oxidative stress, anti-inflammatory properties that suppress inflammatory mediators, and antimicrobial efficacy against a range of bacterial and fungal pathogens. Additionally, preliminary findings suggest cytotoxic and anticancer potential, as well as promising effects in the management of diabetes, liver protection, and neurological disorders. These findings lend strong scientific support to the traditional uses of the plant and position it as a promising candidate for future drug development. However, while *in vitro* investigations provide valuable preliminary data, they are only the first step in the journey toward therapeutic validation. The biological activity observed in controlled laboratory settings must be substantiated by rigorous *in vivo* experiments and clinical studies to confirm safety, efficacy, bioavailability, and pharmacokinetics in complex biological systems. Moreover, understanding the exact mechanisms of action of individual phytochemicals, as well as identifying any potential interactions or toxicities, is essential for the safe use of *Premna Serratifolia* in modern pharmacotherapy. Standardization of extract preparation, dose optimization, and quality control measures are equally important to ensure reproducibility and reliability of results. In conclusion, while the *in vitro* data strongly support the therapeutic relevance of *Premna Serratifolia*, the current body of research still leaves considerable gaps. Future research should focus on bridging these gaps through systematic pharmacological evaluations, toxicological profiling, and clinical validations, thereby paving the way for the incorporation of this valuable plant into mainstream healthcare and novel drug formulations. The remarkable pharmacological promise of *Premna Serratifolia* reaffirms the importance of exploring medicinal plants as sustainable and effective sources for new therapeutic agents.

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