

E-ISSN: 2709-9369
P-ISSN: 2709-9350
www.multisubjectjournal.com
IJMT 2025; 7(1): 36-37
Received: 15-11-2024
Accepted: 21-12-2024

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Pharmacological Investigation of *Mesua ferrea*

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Abstract

Mesua ferrea, commonly known as the Ceylon ironwood or Nagkesar, is a medicinally significant plant widely distributed in tropical and subtropical regions. This study investigates the pharmacological properties of *M. ferrea*, focusing on its bioactive constituents and therapeutic potential. The plant is rich in secondary metabolites, including flavonoids, phenolic acids, xanthenes, and essential oils, which contribute to its wide spectrum of biological activities. Preliminary investigations reveal that various parts of *M. ferrea*-such as flowers, seeds, bark, and leaves-exhibit diverse pharmacological effects. The plant shows significant anti-inflammatory, antimicrobial, antioxidant, antidiabetic, and hepatoprotective activities. Studies on its extracts also highlight its analgesic, antipyretic, and anticancer properties, attributed to its potent free radical scavenging and enzymatic modulation capacities.

Furthermore, toxicological evaluations confirm the safety of *M. ferrea* extracts at therapeutic doses. However, detailed clinical studies are necessary to substantiate its traditional uses and identify potential side effects or drug interactions. This review underscores the plant's potential as a source of novel therapeutic agents and encourages further exploration to unlock its full pharmacological benefits.

Keywords: *Mesua ferrea*, pharmacology, bioactive compounds, anti-inflammatory, antioxidant, traditional medicine.

Introduction

Mesua ferrea (commonly known as the Ceylon ironwood, Nagkesar, or Cobra's Saffron) is a medicinally significant plant belonging to the family *Calophyllaceae*. This evergreen tree, native to tropical Asia, has a rich history in traditional medicine systems, including Ayurveda, Siddha, and Unani, owing to its diverse therapeutic properties.

Phytochemical Constituents

The bioactivity of *Mesua ferrea* is attributed to its rich phytochemical profile, including:

Flavonoids: Quercetin, mesuaferrin.

Xanthenes: Mesuaxanthone A, mesuaxanthone B.

Triterpenoids: Lupeol.

Fatty acids: Linoleic acid, oleic acid.

Essential oils: Caryophyllene, cadinene.

These compounds contribute to the plant's pharmacological activities.

Pharmacological Properties: A variety of pharmacological investigations have validated the traditional uses of *Mesua ferrea*. Key activities include:

Anti-inflammatory Activity

- Extracts from the seeds and flowers exhibit significant inhibition of inflammatory mediators.
- Active compounds, such as mesuaferrone and xanthenes, show potential in modulating pathways like COX and LOX.

Antimicrobial Activity

- Extracts of the flowers and leaves demonstrate potent antibacterial and antifungal properties.
- Essential oils are particularly active against gram-positive bacteria and dermatophytes.

Antioxidant Activity

- The methanolic and aqueous extracts are rich in flavonoids and xanthenes, which scavenge free radicals and protect against oxidative stress.

Anticancer Activity

- Preliminary studies suggest cytotoxic effects against specific cancer cell lines.
- Xanthones derived from *Mesua ferrea* exhibit pro-apoptotic and anti-proliferative properties.

Antidiabetic Activity: Seed extracts have shown promising results in lowering blood glucose levels in animal models.

Hepatoprotective Effects: Protective effects against chemically-induced liver damage have been reported, possibly due to antioxidant and anti-inflammatory mechanisms.

Cardioprotective and Lipid-lowering Activity: Some studies suggest potential benefits in reducing cholesterol and triglyceride levels, improving overall cardiovascular health.

Wound Healing Properties

- The plant's extracts, particularly the flower oil, are traditionally used in wound healing and skin infections, backed by antimicrobial and anti-inflammatory effects.

Toxicological and Safety Profile

- Acute and sub-chronic toxicity studies indicate that *Mesua ferrea* extracts are relatively safe at therapeutic doses.
- High doses may result in mild gastrointestinal irritation or other reversible effects in animal models.

Applications in Traditional Medicine

In Ayurveda, *Mesua ferrea* is used to treat:

- Respiratory disorders (e.g., asthma, bronchitis).
- Gastrointestinal issues (e.g., diarrhea, dysentery).
- Rheumatism and joint pain.
- Skin conditions (e.g., eczema, ulcers).

Future Directions for Research

Clinical Trials: More human studies are necessary to validate preclinical findings.

Mechanistic Studies: Exploring molecular pathways of action for its active compounds.

Formulation Development: Development of standardized herbal formulations for specific diseases.

Mesua ferrea continues to attract interest due to its therapeutic potential, making it a promising candidate for modern drug discovery and development.

Would you like references or further elaboration on specific pharmacological activities?

Conclusion

M. ferrea is being used in India and several parts of world for its potential medicinal and several other properties. The plant is known for its antioxidant, analgesic, anti-inflammatory, antitumor, immunostimulant, antimicrobial, and several other activities. It is an ingredient of several Ayurveda and unani formulations. The phytochemical screening confirms the presence of phenyl coumarins, xanthones, triterpenoids, fats and flavonoids as main constituents of the plant. Apart from medicinal uses it is also being used commercially in polymer industry, painting, as a firewood and substitute for gasoline, preparation of nanoparticles. Therefore, further studies may be carried out to prove the potential of this plant as well as the isolated products. Besides this, the systemic studies of

pharmacological aspects of the plant are under way by our research team.

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