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NAGKESAR (Mesua ferrea linn.): A POTENT HERB

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ABSTRACT

Many plants have not been investigated thoroughly, which are used traditionally as a medicine to cure various diseases. Herbal plants play a vital role in the development of new drugs which can be used for various therapeutic indications. *Mesua ferrea linn.*, commonly known as 'Nagchampa' or 'Nagkesar', is one such herbal plant having many potential therapeutic activities. It is used in diseases like rheumatism, asthma, inflammation, fever, dyspepsia, renal diseases, dysentery, bleeding piles, a bacterial and fungal infection. This plant possesses many bioactive chemical constituents like coumarins, xanthones, pyranoxanthones, flavonoids, terpenoids and steroids which can be easily isolated. It can act as precursors on many ailments. These bioactive constituents have many pharmacological activities such as anticancer, antimicrobial, antifungal, anti-inflammatory, anti-arthritis, analgesic, diuretic, anti-hemorrhoid, antiulcer and many more. Almost every part of the plant is reported to have beneficial medicinal properties. But further studies are still needed to explore the pharmacological activities of *Mesua ferrea linn.* plant so as to gain benefit for the treatment of various diseases. This review highlights the general description, phytochemical profiling, traditional uses and proven pharmacological attributes of *Mesua ferrea linn.* plant.

Keywords: *Mesua ferrea*, Antimicrobial activity, *Nagkesar*, Cobra saffron, Ayurveda

INTRODUCTION

Among the ethnobotanical plants is Nagkesar (Mesua ferrea Linn). Many studies are being conducted on it to learn more about Nagkesar's actions, and it has been used historically. Plants that were originally employed as medicines are still widely used, while ethnobotanical plants that have been used since ancient times are still used today 0064ue to societal and cultural beliefs.1,2From ancient times till the present, the use of herbal or plant-based medications has been influenced by the medical systems of Ayurveda, Siddha, Unani, Egyptian, and Chinese medicine .3 Mesua Ferrae Linn. is a member of the Clusiaceae family. It is often referred to as Nagkesara in Hindi and Ceylon Iron Wood in English. Found widely throughout the Himalayas from Nepal eastward, as well as in north India, the Deccan Peninsula, and the Andaman Islands, up to a height of 1,500 meters, it can be a medium-sized tree or a huge, evergreen tree with a small, short trunk. Because they are so beautiful and elegant in nature, trees are grown for their blossoms. Its leaves and blossoms both have strong therapeutic properties and high value, and they can be used as an antidote for deadly snake bites. One of its most significant and important uses is on its blossoms, as a paste made from them with a mixture of sugar and butter is quite effective in treating and curing foot burns and bleeding piles. Its seed oil may be useful for treating itching.[4] Nagakeshara is one of the *Cathurjata*.[5] The pharmacological properties of the Mesua ferrea plant have been the subject of extensive research in recent years. According to published research, the plant possesses significant biological qualities, including immunomodulatory, antibacterial, anticancer, and anti-inflammatory effects. Tables 1 and 2 provide the *Nagkesar*'s vernacular names and taxonomical classification, respectively.[6]

Table 1: Vernacular names of *Nagkesar (Mesua ferrea linn)*

Sanskrit - Kesara, Nagapuspa, Naga, Hema, Gajakesara
Hindi- Negkesara, Pila Nagesara
English- Cobras Saffron

Table 2: Taxonomical classification of *Nagkesar (Mesua ferrea linn)*

Genus- Mesua L.
Family -Guttiferae/Calophyllaceae
Common Name- Nagkesar

Botanical description of *Nagkesar (Mesua ferrea linn)*

The evergreen ornamental plant Mesua ferrea Linn. can grow up to 13 mm in height, with a trunk that can reach 90 cm in diameter and is frequently buttressed at the base. The plant has simple, narrow, ovate, egg-shaped leaves that range in length from 3 to 5 inches. Newly emerging leaves are crimson, then gradually turn yellow. The leaves are dark green with a whitish underside. The plant's flowers have four white petals and a center full of yellow stamens, and they range in diameter from 4 to 7.5 cm. The oblong-shaped fruits have a persistent calyx and are between 2.5 to 5.0 cm in length. The cotyledon is oily and meaty, and the flower, fruit, seeds and leaves of this plant are edible[7]

Fig. 1: Mesua ferrea linn. Flower

Distribution-The dense mountains of the Eastern Himalayas, Bengal, Assam, Tenasserim Burma, and the Andamans are home to Mesua Ferrae Linn, which is widely and regularly dispersed throughout these regions.[8]

Parts used : Flower (stamen), Seed, Fruits, Leaves, Root Oil, Bark, Bud [9]

Phytoconstituents of *Mesua ferrea linn*

According to phytochemical research, plants in this genus are abundant in a variety of secondary metabolite groups, including as triterpenoides, xanthones, and phenylcoumarins.[10,11,12]

About 75% of the kernels' yellowish oil is made up of common fatty acid glycerides such as stearic, arachidic, oleic, and linoleic acids. From the seeds, an oil known as nahor is produced.[13]

The seed oil of Mesua ferrea was used to isolate phenylcoumarins such as mesuol, mesuagin, mammeisin, mammeigin, and mesuone. 4-alkylcoumarins ferruols A and B, a triterpenoid of the lupeol type guttiferol, mesuaxanthone, 1,5-dihydroxy-3-methoxyxanthone, 1-hydroxy-7-methoxyxanthone, and β-sitosterol were found in the trunk bark and heartwood. Stamens give α and β-amyrin, β-sitosterol, bioflavonoids-mesuaferrones A and B, mesuanic acid, 1,5-dihydroxyxanthone, euxanthone 7-methyl ether and β-sitosterol. Other isolated constituents were mesuaferrol, leuco anthocyanidin, mesuone, euxanthone, etc. Presence of xanthone derivative and essential oil had also been reported from various parts of the plant.[14] The heart-wood extract of M. ferrea has yielded two novel yellow pigments, meauxanthone A and memaxantbone B. Mesuferrone-A and B, mesuaferrol, mesuanic acid, and α and β-amyrin are all found in the stamens that produce the medication Nagakeshara.[15]

Ayurvedic view of Nagkesar (*Mesua ferrea* Linn)

Health is a balanced condition of Doshas (three biological humors, namely Kapha (Water and Earth), Pitta (Fire), and Vata (Space and Air), as well as dhatus (seven body tissues), digestion, and tranquility of spirit, mind, and senses, according to the Sushruta Samhita[16,17,18]. Nagkesar is one of the many wonderful herbs that Ayurveda has described. Life is not just about being alive; it's also about being well and leading a healthy life. In Ayurveda, it is also referred to as Sirunagappu, Indian rose chestnut, Ceylon ironwood, and cobra saffron.

It brings the body's three Doshas into harmony. It is primarily taken into consideration for bleeding issues brought on by an imbalance in Pitta (heat). Nagkesar is mostly recommended for bleeding disorders such as epistaxis, menorrhagia, metrorrhagia, and piles because it calms the Pitta, which is responsible for maintaining the heat imbalance. Excessive bleeding is cured by this plant. It also has hemostatic and

aphrodisiac properties. Because to its sheet Virya (cool nature) and astringent Kashaya rasa, it primarily acts on the blood capillaries. Additionally, it contributes to improving Metrorrhagia's circumstances.[19,20,21]

For the treatment of a variety of ailments, Mesua ferrea is used in various sections, either by itself or in combination with other therapeutic herbs. Dried flowers have stomachic and anti-inflammatory qualities [22]. Traditionally, the bark has been used to cure vomiting, sore throats, coughs, and dysentery [23]. For bleeding piles, Mesua ferrea is recommended in combination with butter and sugar. Mesua ferrea is an ingredient in the Ayurvedic formulation "Maharishi Amrit Kalash-4," which is traditionally used to cure cancer [24,25]

Rasa panchak of Nagkesar(Table-3)

Table 3: *Rasa panchak* of *Mesua ferrea linn.* (Nagakesara) Sanskrit/English	**Sanskrit(English)**
Virya/Potency	*Ushna*(Hot Potency)
Vipaka/Metabolic property	*Katu*(Pungent)
Guna/Physical Property	*Laghu, Ruksha*(little, Dry)
Rasa/Taste	*Kashaya, Tikt* (Astringent, Bitter)

Pharmacological activities

a) Immunomodulatory activity

In experimental animals on sensitized + cyclophosphamide (50 mg/kg, i.p., 9th and 16th day) induced SRBC (sheep red blood cells) specific and non-specific immune response models, mesuol extracted from M. ferrea seed oil was assessed for immunomodulatory activity. In humoral and cellular immune response models, the constituent significantly increased the paw volume and antibody titer in a dose-dependent manner. Rats' hematological profile, neutrophil adhesion, and phagocytosis in the carbon clearance experiment all improved, indicating mesuol's immunomodulatory action.[26]

a) **Analgesic activity**

When mice trembled in response to acetic acid, three extracts of M. ferrea leaves—n-hexane, ethyl acetate, and methanol extracts (125 and 250 mg/kg)—showed analgesic efficacy.In hot plate and tail immersion studies, the mesuol significantly reduced the twitching that acetic acid caused in mice. In rats, mesuol was also observed to lessen paw edema brought on by carrageenan.[27]

c) **Antispasmodic activity**

Petroleum ether extract of M. ferrea seed oil prevented acetycholine and carbachol from causing rat ileal spasms in in vitro experiments. In comparison to the impact achieved with atropine, the effect was shown to be more substantial.[28]

d) Anti-arthritis activity

In two distinct in vivo models—rats with arthritis produced by formaldehyde and rats with arthritis induced by Complete Freund's Adjuvant (CFA)—the seed extract of Mesua ferrea exhibits strong anti-arthritis efficacy. In rat models, the results demonstrated a decrease in the arthritic lesion by swelling volume in the paw that received a CFA injection.[29]

e) Antibacterial efficacy

Mesua ferrea leaf and fruit extracts demonstrated strong antibacterial activity against S. aureus, exhibiting bacteriostatic effects at a dosage of 0.39 mg/ml and an inhibitory concentration of 0.048 mg/ml.[30]

f) Hepatoprotective activity

In a study, methanolic extract of dried M. ferrea flowers (100 and 200 mg/kg) significantly increased liver SOD and AST and decreased catalase, GPX, GR, and ALT activity in hepatotoxic mice infected with S. aureus, while having no effect on CPK and creatinine levels.[31]

g) Anti-venom activity

In cells pre-incubated with H. laoticus venom, the aqueous extract of M. ferrea leaves studied for their anti-venom efficacy against Heterometrus laoticus scorpion venom induced fibroblast cell lysis showed protection against venom induced lysis, supporting its utility against snake bite.[32]

h) Anti-ulcer activity

Only albino rats that had been pre-treated with xanthones showed anti-ulcer activity in pyloric ligation.[33]

i) Wound healing activity

In albino rats used in excision and incision models, topical administration of ethanolic extract of dried Mesua ferrea flowers (5% and 10% w/w) ointment of bark extract in simple ointment base shown considerable wound healing activity in comparison to the control group.[34]

j) Anti-inflammatory activity

When compared to conventional anti-inflammatory drugs, the ethanolic extract of Mesua ferrea Linn flower at 400 mg/kg b.w. had the most anti-inflammatory effect in a rat paw edema model generated by carrageenan.

k) Anti-cancer activity

In vitro experiments shown strong antiproliferative activity of M. ferrea's crude ethanolic extract against human cholangio carcinoma (CL-6), human laryngeal (Hep-2), and human hepatocarcinoma (HepG2) cell lines. Strong cytotoxic activity against Hep-2 and HepG2 was also noted in additional investigations.[35,36]

l) Anti-convulsant activity

Maximum electroshock seizure (MES) in albino mice was considerably reduced by an ethanolic extract of M. ferrea flowers.[37]

m) Anti-histaminic activity

According to reports, a phenol-containing fraction of Mesua ferrea seed oil enhanced the relaxation of guinea-pig tracheal smooth muscle caused by isoprenaline both in vitro and in vivo, but it lacked bronchodilatory activity.[38]

Uses of *Nagkesar* in cosmeceuticals

In addition to its medical uses, nagkesar is valued for its cosmetic properties. Nagkesar has advantages for both hair and skin. Because of its high antioxidant content, nagkesar has positive effects on skin, including reducing acne and scars, minimizing spots and blemishes, lowering pigmentation, and acting as an anti-aging agent. It gives the skin profound nourishment, minimizes pores, revitalizes the skin, and hydrates it. Its astringent qualities aid in the treatment of wounds, scabies, and burning sensations while promoting healthy, natural skin. Nagkesar's anti-inflammatory properties contribute to rejuvenating the skin by reducing redness, swelling, and itching. It eliminates tan from the skin's surface and avoids oily skin issues. It preserves the suppleness and natural skin tone. Because it reduces excessive perspiration, it keeps the body from smelling foul.[39]Nagkesar encourages hair growth and thickness. It shields hair from heat damage, keeps hair shiny, clears tangles, and nourishes hair from the ground up. Because of its antistress properties and antioxidant action, which regulate excessive hair loss, encourage the creation of new hair, and naturally increase hair volume, it strengthens hair from the roots, regenerates hair from hair follicles, and prevents hair breakage. Nagkesar aids in stimulating the hair follicle or root, which enhances the development of strong, healthy hair from the scalp.[40]

Conclusion-

Nagkesar(Mesua ferrea Linn.) demonstrates significant therapeutic potential due to its diverse bioactive compounds, including flavonoids, xanthones, coumarins, and terpenoids. These compounds contribute to its wide array of pharmacological activities, such as antimicrobial, anticancer, anti-inflammatory, anti-arthritic, analgesic, and immunomodulatory effects. Traditionally valued in systems like Ayurveda,*Nagkesar(Mesua ferrea Linn.)* has been used to treat various conditions, including bleeding disorders, skin ailments, rheumatism, and digestive issues. While its traditional use is well-documented and supported by emerging scientific research, further studies are needed to fully explore its pharmacological potential. Additionally, the plant's relevance in cosmeceuticals highlights its versatility, particularly in skin and hair care applications. *Mesua ferrea Linn.* continues to be a valuable natural remedy, with the potential for more comprehensive integration into modern medicine in the future.

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