



Nagakesara (Mesua ferrea Linn.): A critical review of ayurvedic literature and modern scientific evidence

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Abstract

Introduction: *Mesua ferrea* Linn. commonly known as *Nagakesara*, is an important medicinal plant widely described in classical Ayurvedic literature. Ancient texts such as the *Charaka Samhita* and *Sushruta Samhita* recognize its significant therapeutic value. In Ayurveda, the stamens of the flower are considered the primary medicinally useful part. *Nagakesara* possesses *Kashaya*, *Tikta rasa*, *Ruksha* and *Laghu guna*, *Ushna veerya*, and *Katu vipaka*, which contribute to its wide therapeutic spectrum. Traditionally, it is used in the management of *Atisara* (diarrhea), *Raktapitta* (bleeding disorders), *Arsha* (hemorrhoids), *Jwara* (fever), and *Kushta* (skin diseases). Recent scientific interest has focused on validating these traditional claims through phytochemical and pharmacological investigations.

Methods: A comprehensive literature review was carried out by examining classical Ayurvedic texts and modern scientific publications. Ayurvedic references related to *Nagakesara* were collected from authoritative treatises such as the *Charaka Samhita* and *Sushruta Samhita*. Modern scientific information was gathered from research articles, pharmacological studies, and phytochemical investigations available in open-access databases. Relevant keywords such as *Mesua ferrea*, *Nagakesara* phytochemistry, and pharmacological activities were used to identify relevant studies. The collected data were analyzed to correlate traditional Ayurvedic knowledge with modern scientific findings.

Results: Phytochemical studies on *Mesua ferrea* have revealed the presence of several bioactive constituents, including flavonoids, xanthenes, tannins, essential oils, and phenolic compounds. These compounds contribute to its various pharmacological activities. Experimental studies have demonstrated antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, and anti-ulcer properties. These findings support many of the traditional therapeutic uses of *Nagakesara* and indicate its potential role in managing metabolic and inflammatory disorders.

Discussion: The integration of classical Ayurvedic knowledge with modern research highlights the therapeutic versatility of *Nagakesara*. Traditional attributes such as *Kashaya rasa* and *Sheeta veerya* correspond with its pharmacological activities. However, further clinical studies, pharmacognostical evaluation, and standardization are required to strengthen its evidence-based use in integrative medicine and future herbal drug development.

Conclusion: *Nagakesara* is a highly valuable medicinal plant with considerable therapeutic potential, and continued scientific research may help in developing safe and effective herbal formulations for treating various diseases.

Keywords: *Nagakesara*; *Mesua ferrea*; Ayurvedic literature; Pharmacological activities; Therapeutic potential; Scientific validation

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1. Introduction

Nagakesara (*Mesua ferrea* Linn.) is a beautiful, evergreen, medium sized shrub to tree with tender branches and reddish-brown bark which exudates a yellowish green gum like resin. Due to its high economic value, it is commonly adulterated with other inferior-quality drugs. In the classical textbook - *Nighantu Adarsha*, it is stated that *Nagakesara* can be substituted with *Surapunnaga* (*Ochrocarpus longifolius* Benth. & Hook. f.).^[1]

1.1. Vedic Period^[2]

The antecedence of *Nagakesara* dates back to Vedic period. The drug has been mentioned in *Atharva Parishishtam* as *Nagapushpa*. In *Amarakosha*, *Nagakesara* has been mentioned as *Champeya* and *Nagachampa* at other places.

1.2. Samhita Period

Brhatrayi- In *Brhatrayis* the term *Nagakesara* (*Mesua ferrea* Linn.) is used for very few times.

Caraka Samhita- *Caraka* mentions *Nagakesara* (*Mesua ferrea* Linn.) as one of the ingredients of *Kanakarishtha* as *lepa* for *Visarpa* and as an ingredient in *Bala Taila* ^[3]. In *Raktarshas*, the use of *Nagakesara*, butter and sugar have been mentioned as very beneficial ^[4].

Sushruta Samhita- ^[5] The term '*Ahipushpa*' is used to denote *Nagakesara*. References are found in *Dravya Sangrahaneeya Adhyaya* under *Eladi gana*, *Vachadi gana*, *Anjanadi gana* and *Priyangvadi gana*. *Eladi gana* is said to be *Vatakaphahara*, *Viśahara*, *Varna Prasadana* and maybe indicated in *Kandu*, *Pidaka* and *Kottha*. *Vachadi gana* is *Stanya shodhaka*, indicated in *Amatisara* and is *Dosha pachaka*. *Anjanadi gana* is *Rakta pittahara*, specially indicated in *Antardaha* and *Visha*. *Priyangvadi gana* is *Pakwatisara nashana*, *Bhagna sandhanakara*, *Pittahara* and *Vranaropana*.

Ashtanga Hridaya- The term '*Ahikesara*' has been mentioned in *Madatyayadi chikitsitam* as follows; During the bout of *Madatyaya Prasakta vega* (intoxication or fainting) it is beneficial to consume the paste of *Maricha*, *Kolasthimajja*, *Ushira* and *Nagakesara* with cold water.^[6] In *Shwasa-Hidhma chikitsitam*, *Jeevantyadi churna* for treatment of *Shwasa* and *Hidhma* has been explained, of which *Nagakesara* is an important ingredient. *Jeevantyadi Churna* mixed with sugar, double its quantity is used as and when desired; in *Parshwaruja*, *Jwara*, *Kasa*, *Hidhma*, *Shwasa*^[7]. For oblations (offerings) to *Nagagraha*, *Nagakesara* and other drugs macerated with cold water used as *Navana* and *Anjana* is beneficial.^[8] *Nagakesara* is an ingredient of *Kalyanaka Ghrta* which is considered to be the best recipe for *Pumsavana*.^[9]

Laghutrayi- Among the *Laghutrayis*, *Sharngadhara*^[10] has mentioned *Nagakesara* in *Purvakhanda* 4th chapter under *Pachana Karma* where as *Bhavamishra* has given a detailed description of the drug in *Bhavaprakasha Nighantu*^[11]. It has been stated that the *Karma* which does *Ama-pachana* without *Agnideepana* is known as *Pachanakarma* and *Nagakesara* is mentioned as an example for *Pachanakarma*.^[12]

Nighantu Period- Almost all the *Nighantus* have given detailed description of *Nagakesara* (*Mesua ferrea* Linn.).

Dhanwantari Nighantu ^[13]- *Nagakesara* is mentioned as the 22nd drug in *Shatapushpadi Varga* of *Dhanwantari Nighantu* and it is the 2nd *Varga* of the *Nighantu*. The synonyms properties and actions and indications of the drug have been mentioned. Synonyms: *Nagapushpa*, *Naga*, *Keshara*, *Champeya*, *Nagakinjalka*, *Kanaka*, *Hema*, *Kanchana* of *Nagakesara* has been given. The *Rasa*- *Pancaka Rogaghnata* and main *Karma* (*Viśaghna*, *Kandughna*) of the drug are mentioned.

Raja Nighantu ^[14]- *Nagakesara* is mentioned in the *Pippalyadi Varga* of *Raj Nighantu*. Here the properties, actions and indications have been mentioned. The *Virya* has specifically been mentioned as *Alpa Uṣṇa*.

Madanapala Nighantu ^[15]- The synonyms, properties, actions & indications of *Nagakesara* are mentioned in the *Karpooradi Varga* as follows: Synonyms like *Nagakesaraka*, *Naga*, *Champeya*, *Keshara*, *Gaja* are given.

Kaiyyadeva Nighantu ^[16]- *Nagakesara* is the 413th drug mentioned in the *Aushadhi Varga* of *Kaiyyadeva Nighantu*, followed by *Trijataka* and *Chaturjataka*. The synonyms, properties, actions and indications of the drug are mentioned.

Bhavaprakasha Nighantu- *Nagakesara* is described in detail in the *Karpuradi Varga* of *Bhavaprakasha Nighantu* which is the 2nd *Varga* of the *Nighantu*. *Nagapushpa*, *Naga*, *Keshara*, *Nagakeshara*, *Champeya*, *Nagakinjalka* and *Kanchanahwaya* (all words representing '*kanchana*' or gold) all such *pullinga* words represent the plant *Nagakesara*. If the above-mentioned words are in *Nappunsakalinga*, it represents the flowers of *Nagakesara*. Properties and actions of

the flowers of *Nagakesara* along with many indications are mentioned. *Bhavamishra* includes *Nagakesara* in *Chaturjataka* and describes *Trijataka* and *Chaturjataka* immediately after the description of *Nagakesara* as follows; *Twak*, *Ela* and *Patra* together in equal quantity is known as *Trisugandhi* or *Trijataka* and when equal quantity of *Nagakesara* is also added, it is known as *Chaturjataka*. These are *Ruchya*, *Rooksha*, *Teekshna*, *Usna*, *Mukhadaurgandhyahara*, *Laghu*, *Pitta* and *Agnivardhaka*, *Varnya*, *Kapha-Vata* and *Vishahara*.

Nighantu Adarsha [17]- The detailed description of *Nagakesara* and its various botanical sources have been compiled in *Nighantu Adarsha*. The 17th *Varga* of *Nighantu Adarsha* - *Nagapushpadi Varga* begins with *Nagakesara* (Yellow variety- *Mesua ferrea*) followed by *Nagakesara* (red variety- *Ochrocarpus longifolius*): *Surapunnaga*, the substitute drug for *Nagakesara*. Then general characteristics of the natural order Guttiferae (*Nagapushpadi Varga*) has been explained. Few common members of the family are mentioned like; *Mesua ferrea* (*Nagakesara*), *Ochrocarpus longifolius* (*Surapunnaga*), *Calophyllum inophyllum* (*Punnaga*), *Garcinia indica* (*Vrikshamla*), *Garcinia mangostana* (*Mangustan*), *Garcinia Morelladesrous* (*Kankushtha*), *Garcinia pedunculata* (*Amlavetasa*). Economic importance of the members such as their oil yielding capacity and medicinal importance has been mentioned. *Nagakesara* (*Mesua ferrea* Linn.) begins with the description of its vernacular names. *Nirukti* of the drug such as *Punnaga*, *Tunga*, *Kesara*, *Devavallabha*, *Nagakesara*, has been explained in detail. Distribution, morphology, parts used, dose, properties and actions and references of *Nagakesara* (*Mesua ferrea* Linn.) in other texts has been briefed. In *Nighantu Adarsha* only, the *Vipaka* of *Nagakesara* has been told. It is mentioned to be of *Katu Vipaka*.

Shodhala Nighantu [18]- In *Shodhala Nighantu*, *Nagakesara* is classified under the *Shatapushpadi Varga*. The drug has been indicated in *Asrgdhara*. It has been mentioned that *Nagakesara Churna* with *Madhu* twice a day along with *Takraprayoga* daily cures *Rakta pradara*.

Siddha bhesaja Manimala [19]- In the text *Gunas* of *Nagakesara* along with *rasa- pancake* and indications are mentioned.

Saraswati Nighantu [20]- *Nagakesara* is mentioned in the *Mahavriksha Varga* which is the 1st *Varga* of *Saraswati Nighantu*. The synonymous Latin name of *Mesua ferrea* has been mentioned as *Mesua coromandeliana* Roxb. in the edited version of the text by Dr. S. D. Kamat.

Shadrassa Nighantu (Abhidhanaratnamala) [21]- *Nāgakesara* is mentioned in the *Katu skandha* along with few synonyms.

1.3. Other texts:

Gada nigraha [22]- Indications of *Nagakesara* are mentioned as *Visha*, *Visarpa*, *Raktarshas*, *Vami*, *Kushtha*, *Hrllasa*, *Krmi*, *Daurgandhya*, *Trsna* and *Pitta kapha hara*.

Rajamartanda [23]- *Nagakesara* is indicated for *Putra prasavartha*. The use of *Nagakesara Churna* in *Rutukala* - *Lehana* with *Goghrtta* followed by the intake of *Godugdha* provides a healthy baby boy.

Vangasena [24]- Indicates *Nagakesara Churna* with sugar candy in *Raktarshas*. Also, for *Garbhasthapana*, *Churna* of *Nagakesara* & *Pooga* (beetle nut) mixed together and given orally is the best as per *Vangasena*.

Bhaishjya Ratnavali [25]- It has been mentioned that in the absence of *Nagakesara*, *Padmakesara* *Kamalapushpakesara* may be substituted.

Contemporary Texts –

Ayurvedic Pharmacopoeia of India [26]- Botanical source of *Nagakesara* is mentioned as *Mesua ferrea* Linn. -*Nagakesara* is the dried stamens of *Mesua ferrea* Linn. The drug has been described in the part 1, 2nd Vol. of API. The synonyms, English names, actions & properties and physicochemical values have been mentioned.

Indian Pharmacopoeia-2014 [27]- *Nagakesara* (*Mesua ferrea* Linn.) is mentioned in the Volume - 3 of IP. Macroscopy, microscopy, TLC, assay, physico-chemical parameters, microbial contamination, storage etc. has been described.

Quality Standards of Indian Medicinal Plants [28]- *Mesua ferrea* Linn. has been explained in the 3rd Vol. of the book. Botanical synonym of the drug has been given. Morphology, vernacular names, description of the macroscopy, microscopy, powder, chemical constituents, TLC Identity tests along with the diagrams, estimation of *Mesua ferrea* in the drug, structure of *Mesua ferrea*, quantitative standards, adulterants & substitutes, pharmacology, major therapeutic claims, safety aspects, dosage & references has been given.

Indian medicinal plants^[29]- Natural order Guttiferae is described in the Vol.1 of IMP. Botanical synonyms, vernacular names, family characters, characteristics of the genus, morphology, properties and actions of *Mesua ferrea* and usage in other system of medicines has been mentioned. Common therapeutic applications of different parts of the drug have been briefed.

Indian Materia Medica^[30]- Dried flower buds of *Mesua ferrea* Linn. are used as fragrant adjuvants to decoctions and medicated oils. The drug is also used in scorpion sting.

The Wealth of India^[31]- The botanical description, the vernacular names, phytochemistry, cultivation, breeding and varieties, pests affecting the plant, various therapeutic uses and research works have been mentioned.

2. Materials and methods

- An extensive and systematic literature survey was undertaken to collect relevant data pertaining to the proposed title.
- Primary textual sources included classical Ayurvedic compendia (*Samhitas*) and authoritative Ayurvedic materia medica and drug lexicons (*Nighantus*).
- These classical texts were critically examined to extract references related to the conceptual framework, pharmacological attributes, therapeutic indications, and traditional formulations relevant to the study topic. In addition to classical sources, secondary literature was comprehensively reviewed.
- This included published books, peer-reviewed research articles, review papers, and other scholarly publications relevant to the subject.
- Electronic databases and authenticated internet resources were also searched to obtain contemporary scientific evidence, including pharmacological, phytochemical, and clinical data where applicable.
- All identified literature was screened for relevance, authenticity, and contextual applicability to the research objective.
- Extracted information was systematically compiled, categorized, and analyzed to ensure coherence with the study design and to establish a robust theoretical foundation for the manuscript.

3. Discussion

Mesua ferrea Linn. is the national tree of Sri Lanka.^[32] The real *Nagakesara* is *Mesua ferrea* Linn. (Calophyllaceae).^[33] *Kesara* in Sanskrit means pollens. *Kinjalka* is the synonym of *Kesara*. So, stamens, pollens or the whole flower of this tree is said to be used in medicine. This is the real *Nagachampaka*. In the bazaars of Gujarat and Bombay, the unripe buds of the flowers of *Ochrocarpus longifolius* (Calophyllaceae) is available. It is known as Ratan *Nagakesara* in Gujarati, because the fruit like buds is red in colour. A third type of *Nagakesara* is also sold in the bazaars as *Nagakesara*. It is the unripe fruits of *Cinnamomum wightii* (Lauraceae) or *Cinnamomum tamala*. The leaves of the tree are sold as *Tamala patra* or *Tejapatra* and the unripe fruits are sold as an adulterant in *Nagakesara*. So, in all there are 3 types of *Nagakesara* found in the bazaars. In the bazaars of South India, there are two types of *Nagakesara*; *Dillenia pentagyna* fruits known as Malabar *Nagakesara* *Nattu Nagakesaram*, sirunagappu. The first is used in Malabar and Madras, the second is mostly used by the Siddha and Tamil Nadu vaidyas. Malabar *Nagakesara* (*Dillenia pentagyna*) is the tender fruit and they are collected from Palani and Nilgiri mountains. It belongs to Dilleniaceae family and is known as '*Bhavya*' in Sanskrit. It is a beautiful tree and there are many species of this genus. The nattu *Nagakesaram* seems to be the unripe buds of *Cinnamomum wightii* or *Kala Nagakesara*.

Botanical name: *Mesua ferrea* Linn. (*Mesua*- after the name of 2 Arab scientists; *ferrea*- rust coloured)
Family: Calophyllaceae (*Nagakesarakula*) (Earlier- Clusiaceae/Guttiferae; Guttiferae: guttetus means marked with drops or spots of different colours)^[34]

3.1. Vernacular names

- Assam- *Nahor*
- Bengal- *Nagesar*, *Nagkesar*
- English- *Iron wood Tree*, *Cobra Saffron*
- Hindi- *Naghas*, *Nagkesar*
- Malayalam- *Nagachempakam*, *Nangu*, *Peri*, *Vainavu*, *Veluthachempakam*, *Veluthapala*^[35]
- Marathi- *Nagachampa*
- Punjab- *Nagkesar*

- Tamil- *Irul, Karunangu, Malainangu, Mannainangu, Nagachambagam, Nagappu, Nagesuram, Nangu, Neernangu, Patai, Pudangoli, Sirunagappu*
- Telugu- *Gajapushpamu, Kesaramu, Kinjalkamu, Nagachampakamu, Nagakesaramu, Sikatimanu, Suvarnamu*
- Urdu- *Narmishka*
- Oriya- *Nageshvar, Nagokesor*

3.2. Synonyms

Table 1 Synonyms of *Nagakesara* as per different authors

Name	D.N	K.N	M.N	B.P.N	R.N	N.A	S.N	Sa.N	Sh.N
<i>Champeya</i>	+	+	+	+	-	+	+	+	-
<i>Hema</i>	+	+	-	-	-	-	+	-	+
<i>Kanchana</i>	+	-	-	-	-	-	-	-	-
<i>Kanakahwaya</i>	+	-	-	-	-	-	-	-	-
<i>Keshara</i>	+	+	+	+	-	-	+	+	+
<i>Naga</i>	+	-	+	+	-	-	+	-	-
<i>Nagakesara</i>	+	-	-	-	-	-	-	+	+
<i>Nagakhya</i>	+	+	+	-	-	-	-	-	+
<i>Nagakinjalka</i>	+	+	-	+	-	-	+	-	-
<i>Nagapushpa</i>	+	+	-	+	+	-	+	-	-
<i>Ibha</i>	-	+	-	-	-	-	-	-	+
<i>Ahipushpa</i>	-	+	-	-	-	-	-	-	-
<i>Hemapushpa</i>	-	+	-	-	-	-	-	-	-
<i>Dooroha</i>	-	+	-	-	-	-	-	-	-
<i>Nagarenuka</i>	-	+	-	-	-	-	-	-	-
<i>Kanchanahwaya</i>	-	-	-	+	-	+	-	+	-
<i>Kesara</i>	-	-	-	-	-	+	-	-	-
<i>Punnaga</i>	-	-	-	-	-	+	-	-	-
<i>Tunga</i>	-	-	-	-	-	+	-	-	-
<i>Devavallabha</i>	-	-	-	-	-	+	-	-	-
<i>Gajam</i>	-	-	+	-	-	-	-	-	-
<i>Natam</i>	-	-	-	-	-	-	+	-	-
<i>Tamalapatrakam</i>	-	-	-	-	-	-	-	-	+
<i>Patram</i>	-	-	-	-	-	-	-	-	+
<i>Romasha</i>	-	-	-	-	-	-	-	-	+
<i>Amalakidalam</i>	-	-	-	-	-	-	-	-	+

3.2.1. Interpretation of Synonyms^[36]

Basonym- stamens are liked by elephants

Morphology related synonyms- *Nagapushpa*: petals resemble hood of cobra. Flowers smell like that of elephant. *Punnaga*- like a *Shreshtha* among *Puman/Purushas*, the tree is *Shreshtha* among *Vrikshas*. *Tunga*- a tall tree. *Kesara*- numerous beautiful stamens, which are also the parts used. *Devavallabh*:- beautiful flowers liked even by *Devas*

Kanchanahwayah- stamens are yellow in colour. *Champeya*- stamens are yellow coloured like that of *Champaka*. *Hemapushpa*- yellow-colored stamens. *Kumbha phala*- fruits are pitcher shaped.

Action based synonyms: *Keshara*- stamens are very useful as medicine.

Other synonyms: *Dwipa*- liked by elephants. *Bhujangakhya*, *Phanikesara*- petals resemble hood of cobra *Hemakinjalka*- yellow-colored stamens *Kinjalka*- stamens are the main parts used *Mahaushadha*- well potent drug *Rukma*, *Suvarna*, *Suvarnakhya*- Golden coloured stamens *Shatapadapriya*: liked by insects due to its attraction Others *Pinjara*, *Punnaga kesara*, *Pushparachana*, *Swaraghatana*, *Phalaka*

Botanical synonyms^[37]- *Mesua nagassarium* (Burm. f) Kosterm.

3.3. Classical categorization

Table 2 Classical Categorization of *Nagakesara* ^[38]

Gana	Text
<i>Eladi, Vachadi, Anjanadi, Priyangwadi</i>	<i>Sushruta Samhita, Ashtanga Samgaraha, Ashtanga Hridaya</i>
<i>Shatapushpadi Varga</i>	<i>Dhanwantari Nighantu, Shodhala Nighantu</i>
<i>Aushadhi Varga</i>	<i>Kaiyyadeva Nighantu</i>
<i>Karpooradi Varga</i>	<i>Bhavaprakasha Nighantu, Madanapala Nighantu</i>
<i>Pippalyadi Varga</i>	<i>Raja Nighantu</i>
<i>Nagapushpadi Varga</i>	<i>Nighantu Adarsha</i>
<i>Haritakyadi Varga</i> ^[39]	<i>Priya Nighantu</i>

3.4. Properties and actions

Table 3 Properties and Actions of *Nagakesara* (*Mesua ferrea* Linn.) as per various texts

Rasapanchaka	Guna-Karma	D.N	M.N	K.N	B.P.N	R.N	N.A	P.N	API
<i>Rasa</i>	<i>Tikta</i>	+	-	-	-	+	+	-	+
	<i>Kashaya</i>	-	-	+	+	-	+	+	+
	<i>Katu</i>	-	-	-	-	-	-	-	+
<i>Guna</i>	<i>Laghu</i>	+	+	+	+	+	+	+	+
	<i>Rooksha</i>	-	+	+	+	-	+	-	+
	<i>Tikshna</i>	-	-	+	-	-	-	-	-
<i>Virya</i>	<i>Alpa Ushna</i>	+	-	-	-	+	+	-	-
	<i>Sheeta</i>	-	-	-	-	-	+	-	-
	<i>Ushna</i>	-	+	+	+	-	-	+	+
<i>Vipaka</i>	<i>Katu</i>	-	-	-	-	-	+	-	+
<i>Doshagnata</i>	<i>Kaphapittahara</i>	-	+	+	+	-	+	-	-
	<i>Kaphahara</i>	+	-	-	-	+	-	-	+
	<i>Vatapittahara</i>			-	-	-		+	-
<i>Karma</i>	<i>Amapachana</i>	-	+	+	+	-	+	-	+
	<i>Viśhahara</i>	-	+	-	-	-	+	+	-
	<i>Kandughna</i>	+	-	-	-	-	-	-	-

<i>Rogaghnata</i>	<i>Daurgandhya</i>	-	+	+	+	-	-	-
	<i>Kushtha</i>	-	+	+	+	-	-	-
	<i>Visarpa</i>	-	+	+	+	-	-	-
	<i>Jwara</i>	-	-	-	+	-	+	+
	<i>Trisha</i>	-	-	+	+	-	+	+
	<i>Kandu</i>	-	-	+	+	-	+	-
	<i>Sweda</i>	-	-	+	+	-	+	-
	<i>Chardi</i>	-	-	+	+	-	+	-
	<i>Hrllasa</i>	+	-	+	+	-	+	-
	<i>Bastivata</i>	-	-	-	-	+	+	-
	<i>Kantharoga</i>	-	-	-	-	+	+	-
	<i>Shiroroga</i>	-	-	-	-	+	+	-
	<i>Raktatisara</i>	+	-	-	-	-	+	+
	<i>Raktarshas</i>	-	-	-	-	-	+	+
	<i>Raktapradara</i>	-	-	-	-	-	+	-
	<i>Vatarakta</i>	+	-	+	-	-	-	-

3.5. Therapeutic uses

- In *Raktarshas*- *Kesara*, *Navaneeta* and *Sharkara* internally - Cha.chi.9
- In *Hikka*- *Sukshma Chuna* of *Nāgakesara*, *Madhu* and *Sita* internally followed by the intake of *Ikshu Rasa* or *Madhoodaka* (*Madhuka Swarasa*) - Su.ut. 50/13.
- For *Putraprasavartha*- the use of *Nagakesara Churna* in *Ritukala* with *Gomutra* followed by intake of *Godugdha* provides a healthy baby boy.
- In *Raktapradara*- *Nagakesara Churna* with *Madhu* twice a day with *Takra* - S.N
- In *Raktarshas*- *Nagakesara Churna* with *Sita* - V.S. *Atisara Chikitsa*
- For *Garbha Sthapana*- *Nagakesara Churna* and *Puga Phala* mixed together and given orally is the best - V.S.
- In *Paadadaha*- *Pushpa Churna* mixed with *Purana ghrta* or *shatadhauta ghrta* is said to be effective in burning sensation of the feet.

3.6. Formulations

Table 4 Formulations of *Nagakesara* (*Mesua ferrea* Linn.)

<i>Churna</i>	<i>Lavanabhaskara Churna</i> , <i>Jeevantyadi Churna</i> , <i>Pushyanuga Churna</i> , <i>Pradaranashaka Churna</i> , <i>Eladi Churna</i>
<i>Vati</i>	<i>Brahmivati</i>
<i>Taila</i>	<i>Guduchyadi taila</i> , <i>Chandanadi taila</i>
<i>Avaleha</i>	<i>Chyawanaprash</i> , <i>Ardrakakhandavaleha</i>
<i>Arishta</i>	<i>Babbularishta</i> , <i>Drakshasava</i> , <i>Pippalyasava</i> , <i>Khadirarishta</i> , <i>Ashwagandharishta</i> , <i>Dashamularishta</i>
<i>Ghrta</i>	<i>Brihat chagalyadi ghrita</i> , <i>Kalyanaka ghrita</i>
<i>Rasayoga</i>	<i>Shatamoolyadi lauha</i> , <i>Brhat shrngabhra Rasa</i> , <i>Gandhaka Rasayana</i>
<i>Others</i>	<i>Suparipaka</i> , <i>Haridrakhanda</i>

3.7. Taxonomical categorization

Table 5 Taxonomical Categorization of *Mesua ferrea* Linn.

Kingdom	Plantae
Class	Dicots
Sub-class	Polypetallae
Series	Thalamiflorae
Order	Guttiferae
Family	Calophyllaceae
Genus	<i>Mesua</i>
Species	<i>ferrea</i>
Botanical name	<i>Mesua ferrea</i> Linn.

3.8. MORPHOLOGY^[40]

3.9. General family characters of Calophyllaceae

- 14 genera, 475 species- recognized by angiosperm phylogeny group (APG) 3.
- Chiefly tropical in distribution, Trees or shrubs with yellow or greenish juice
- Leaves-opposite or rarely verticillate, usually coriaceous, exstipulate
- Flowers- solitary or in axillary or in terminal fascicles, racemes or panicles; white, yellow or red, regular, dioecious, polygamous or hermaphrodite; calyx & corolla- 4-12 in numbers, imbricate, in 2-3 series;
- stamens- usually indefinite; filaments- 1-6, adelphous or quite free; Gynoecium: staminodes - numerous, free or connate; ovary- 1-2 or many celled; style- 1 or 0, rarely 2 usually short; stigma- free or connate, often peltate, as many as the cells; ovules - 1 or 2 or many, axile, basal, rarely parietal; fruits usually indehiscent ,occasionally capsule; seeds large, embryo with radical and small cotyledons.

3.10. Characteristics of the genus - *Mesua*

- Trees or shrubs
- Leaves - closely and finely penni nerved
- Flowers - hermaphrodite or polygamous, axillary, solitary, large; sepals-4, petals-4, stamens - indefinite, filaments- free or connate at the base, anthers- erect, oblong, 2-celled, dehiscing longitudinally; ovary- 2-celled, ovules-2 in each cell, erect; style-elongate, stigma - peltate.
- Fruits- between fleshy & subwoody, 1 celled by the absorption of the septum, seeds-1-4, testa - fragile.
- Other members of the genus- *Mesua beccariana*, *Mesua ferrea*, *Mesua congestiflora*

3.11. Characteristics of *Mesua ferrea* Linn.

- A medium sized glabrous tree.
- Trunk- straight, erect
- Bark- smooth, ash coloured
- Young branches-twiggy, slender
- Leaves- simple, opposite, 7.5-12.5 by 2.5-3.8cm; oblong to lanceolate, acute or acuminate, red when young, later glabrous above, glaucous or pruinose beneath, rounded or acute at the base with close inconspicuous nerves; petioles- long (6-8 mm).
- Flowers- very fragrant, axillary or terminal, solitary or in pairs, subsessile; Buds-subglobose; bracts-0; sepals- 4, orbicular, cupped, persistent, inner pair much longer than the outer; petals-4, pure white, spreading, ovate to cuneate with crisped and undulate, margins often torn;

stamens- numerous, golden yellow, much shorter than the petals, slightly united at the base into a fleshy ring, anthers-oblong; style- twice, as long as the stamens, stigma- peltate.

Fruits- 2.5-3cm long, ovoid with conical point, surrounded by the enlarged sepals; pericarp- tough, semi woody, 2 valved; seeds- 1-4 angular, smooth, chestnut-brown.



Figure 1 Flowers of *Mesua ferrea* Linn.

Parts used: Stamens, Flower-buds, Flowers, Fruit, Seed, Root, Bark, Oil

Description of the main useful part: Macroscopy of stamens (*pumkeshara*)^[41] - Stamen consists of the anther, connective and filament. When dried becomes coppery or golden brown in color. Stamens are upto 5mm long and very thin; less than 1mm on thickness and tapering at both the ends. Filaments- copper colored, 0.8-1cm long, slender, filiform, more or less twisted, united at the base forming a fleshy ring, soft to touch, quite brittle. Anther - 0.5 cm long, linear, basifixed, containing pollen grains Connective- not visible with naked eye odor- fragrant Taste-astringent Touch-coarse to tough in texture

Microscopy of the Flower: Stamens have long hairy filaments and somewhat thick, tetrasporangiate, elongated anther lobes. Some fused stamens exhibit vascular strands also. Occasionally the fusion may involve the anther lobes as well. In such cases, however, fusion of the anther lobes is not complete. On anther lobes long, unicellular, multicellular, uniseriate and stellate trichomes are present however, on filament, unicellular, multicellular and uniseriate trichomes only are observed. The cells of connective are lignified and papillate. TS passing through anther lobes shows tetrasporangiate condition, single layered, elongated papillated epidermis interrupted by unicellular, multicellular, uniseriate trichomes followed by single layered thick walled fibrous endothecium near the dehiscence line but become gradually multicellular towards the connective, cells are parenchymatous and contain spiral band of lignified thickening appearing as beads on the walls in surface view, a vascular strand contains annular to spiral vessels. In surface view the cells of the epidermis of the filament show straight anticlinal walls and anisocytic stomata. Pollen grains are 3- (4-) zonocolporate with average size 35.89 - 48.71µm

3.11.1. Powder:

On microscopic examination it shows abundant pollen grains in different planes, fragments of beaded endothecium cells, parenchymatous cells of endothecium with spiral band of lignified thickening and thick walled cells of connective, different types of trichomes (unicellular, multicellular uniseriate, stellate trichome of anther lobe and unicellular multiseriate trichome of filament) epidermal cells with traces of trichome and stomata of filament, vessel with spiral and annular secondary wall thickening. Powder when treated with nitrocellulose in amyl acetate becomes olive green in color under UV 366 nm.

3.12. Chemical constituents^{[42],[43]}:

- Flowers- contain a yellow coloured highly fragrant essential oil; 4-Alkyl and 4-phenyl coumarins were isolated from the blossoms.^{[44],[45]}
- stamens- specifically contain mesuanic acid, mesuafferol, amyrrin, β - sitosterol, biflavonoids- mesuaferrone A & B, cyclohexadione, 1, 5-dihydroxyxanthone and euxanthone-7-methyl ether.
- Heartwood- xanthenes- euxanthenes, dehydrocycloguanadin, mesuaxanthenes A & B^[46], 1, 5-dihydroxyxanthone, 7-methyl ether, β -sitosterol, 1, 5-dihydroxy-3-methoxyxanthone and 1, 5, 6-Trihydroxyxanthone^{[47],[48]}.

- Seed- contains the coumarins- mesuagin, lactones- mesuol, mesuone, mammeisin^{[49],[50]} Fixedoil- oleic acid, stearic acid, palmatic acid, linoleic acid^[51]
- Trunkbark-4-alkyl coumarin-feruol A, bixanthon- mesuaxanthone A&B, Friedelin and stigmasterol.^[52]
- Leaves- flavones glycoside- mesuein; 12, 13- furano- 8- hydroxynaphthyl- 6- 0- b- 2', 3', 4', 6' tetrahydroxy- 5'; 5' dimethyl cyclohexyl ether.^{[53],[54]}
- Root bark- Mesuaferrin A, Mesuaferrin B, caloxanthone C, 1, 8-dihydro-3-methoxy-6-methylanthraquinone, sitosterol, friedelin and botulinic acid.^[55]

3.13. Substitutes:

- *Rakta Nagakesara*- flower buds of *Ochrocarpus longifolius* (*Surapunnaga*)
- *Krishna Nagakesara*- young fruits *Cinnamomum tamala* (*Tamala*)
- *Malabar Nagakesara*- *Dillenia pentagyna*
- *Punnaga*- *Calophyllum inophyllum*

3.14. Propagation and cultivation^[56]:

The plant requires well drained, deep, fertile soil. Stiff clay and low-lying situations are unsuitable. Natural reproduction is generally profuse. Artificial propagation may be done by direct sowing or by transplanting nursery raised seedlings. Transplanting is preferable under top canopy shade and may be carried out from the first to the third rainy season after sowing. A spacing of 2mt. is recommended. The rate of growth is slow. The tree grows faster after transplantation than that in natural forests. The tree is cultivated in the gardens and avenues for its flowers and foliage which are attractive, particularly when young (Wealth of India, 1962). *Mesua ferrea* Linn. is found in moist or semi- evergreen forest, either scattered or in more or less pure patches or belt. It requires well drained, deep fertile soil with a neutral pH; stiff clay and low-lying situations are unsuitable. It is a strong shade bearer, particularly when young and this makes it a valuable component of the middle storey in forest (Wealth of India, 1962). It is susceptible to frost and drought, but these conditions are practically unknown in its natural habitat (Kadambi K, 1954). The tree is affected by brown cubical rot and white sap and heart rot. It is also attacked by beetles like *Xyleborus discolor* Blandford, *Xyleborus interjectus* Blandford and a few others as well as by a buprestid borer, *Chrysobothris* species (Mathur R N, 1958). The seedlings can be planted in the field after one or two years as it is known the tree growth is very slow and is not much known for plantation. It must be transported via road as its log is highly sinkable in water. Seeds of *M. ferrea* are easy to handle and its germination is good and rapid in nursery. Rate of germination is 30-70% as germination is hypogeal as a seed fastly loses their viability between a period of 2-3 months. So, management and storage are done using perforated polythene bags at 50°C protection from sunlight and moisture. It can be attacked by termite and fungus well known as *Ganoderma lucidum* causes root and butt rot disease in plant as the larva of the fungus feed on the sap of the leaves of the plant. Fairly rich and well-drained soil is suitable for the best growth of *M. ferrea*.

3.15. Toxicology^[57]:

The LD₅₀ of ethanolic extract of whole plant in mice was 500 mg/kg i.p. LD₅₀ of acetone extract of stamens in mice was 400mg/kg i. v. and non- toxic up to 1600 mg/ kg p.o. Sometimes, the flowers extracts of plant *M. ferrea* result in lack of implantation in rats and also prevent pregnancy.

3.16. Modern uses

- Leaves are used in the form of poultice which is applied to head in severe colds.^[58]
- Bark and root in decoction or infusion or tincture is a better tonic and are useful in gastritis and bronchitis.^[59]
- Fixed oil expressed from the seeds is used as an application for cutaneous affections, such as sores, scabies, wounds etc.^[60]
- A syrup of the flower buds (1 in 10) is given for the cure of dysentery.
- Dried flower buds are used as fragrant adjuvants to decoctions and medicated oils.^[61]
- The drug is also used in scorpion sting.^[62]
- Dried flower buds are used like cinnamon, cardamom etc. in great thirst, irritability of the stomach and excessive perspiration and also given in dysentery with benefit.
- A paste is used to fillup the cavities of decayed teeth to relieve toothache.

3.17. Research works

- A compound preparation comprising *Nagakesara* (*Mesua ferrea* Linn.), *Ayapana* (*Eupatorium triplinerve*), *Jeevanti* (*Leptadenia reticulata*) and *Kamboji* (*Breynia patens*) was subjected to clinical evaluation in controlled clinical trial on 100 women who had bleeding episodes after insertion of copper-T following M.T.P. Satisfactory

response in control of bleeding either immediate or as menorrhagia and metrorrhagia was seen in 90% whereas in control group it was 60%.^[63]

- The 50% ethanolic extract of whole plant (except roots) showed hypotensive action in cat/dog, antispasmodic activity in isolated guinea pig ileum and diuretic activity in rat. LD₅₀ of the extract in mice was 500 mg / kg i.p. (Dhar *et al.*, 1973).^[64] Phenolic constituent of the seed oil revealed potent anti histaminic effect (Bhide & Naik, 1979). Mesuaxanthonones A, B and euxanthone have produced varying degrees of CNS depression, characterized by ptosis, sedation, decreased spontaneous motor activity, loss of muscle tone, potentiation of phenobarbitone sleeping time and ether anaesthesia in mice and rats. These compounds were devoid of analgesic, antipyretic, anticonvulsant and CVS actions. The xanthonones (50mg/kg) exhibited significant anti-inflammatory activity against carrageen induced hind paw oedema, cotton pellet test as well as against granuloma pouch technique in normal and adrenalectomised rats. The xanthonones had no mast cell stabilizing effect and did not prevent the mast cell degranulating effect of standard agents like compound 48/80. Prothrombin time was also not altered by xanthonones in rats (Gopala krishnan *et al.*, 1980). Mesuol and mesuone were found to inhibit *Staphylococcus aureus*, *Escherichia coli*, *Eberthellatypcosa*, *Vibria cholerae*, *B. friedlander* etc. They were most effective against *Staphylococcus aureus* (Chakraborty *et al.*, 1959).
- The oil from floral buds showed antibacterial activity against *B. subtilis*, *Vibria cholera*, *Staphylococcus aureus*, *Staphylococcus albus*, *Salmonella typhi*, *Salmonella lutea*, *Streptococcus faecalis*, *Streptococcus pyogenes* etc. (Kr & Jain, 1971).
- The essential oil from the fruits showed antibacterial activity against *Tricophyton terrestre*, *T. tonsurans*, *T. mentagrophytes*, *Histoplasma capsulatum* (maximum inhibition), *Candida albicans*, *Monosporium apoispermum* etc. (Jain & Jain, 1973).
- The essential oil from the stamens showed antimicrobial activity against *Candida tropicalis* (Kakrani *et al.*, 1984). Mesuarin exhibited anti-bacterial activity against *Bacillus fermis*. The essential oil from the stamens showed anthelmintic activity against tapeworms and hookworms (Kakrani *et al.*, 1984). The seed oil has shown to potentiate bronchodilator activity of isoprenaline both *in vitro* and *in vivo* experiments. The activity was located in the phenolic compounds isolated from the seed oil. (Annual Report - CCRIMH, 1975-76).
- In one of the clinical trials powders of *Mesua ferrea* stamens 1gm thrice daily orally administered to 20 female patients suffering from *Sveta Pradara* (Vaginal moniliasis) showed significant improvement in all the cases treated (Bhoit P.V., 1994).
- Flavonoids extracted from *Mesua ferrea*, *Ficus benghalensis* and *Jasminum auriculatum* were shown to suppress the release of mediators related to immune suppression at higher doses in the form of CD14 monocyte surface marker and blood counts. All isolated compounds (xanthonones) showed moderately antibacterial activity against *E. coli* and *S. aureus*.
- The mixture of α -amyrin and β -amyrin exhibited anticancer activity.^[65] The extracts from seven plant species (*Atractylodes lancea*, *Kaempferia galanga*, *Zingiber officinale*, *Piper chaba*, *Mesua ferrea*, *Ligusticum sinense*, *Mimusops elengi*) and one folklore recipe (Pra-Sa-Prao-Yhai) exhibited promising activity against the cholangiocarcinoma CL-6 cell line with cell survival of less than 50% at the concentration of 50 μ g/ml (Sukanya *et al.*). The wound healing activity of ethanolic extract of dried flowers of *Mesua ferrea* evaluated on excision and incision model, in albino rats, in the form of an ointment with two concentrations (5% and 10% w/w ointment of bark extract in simple ointment base). Both concentrations of the ethanolic extract showed significant response in both the wound types tested when compared with the control group. Nitrofurazone ointment (0.2%w/w) used as standard (Choudhary *et al.*).

Antioxidant and hepatoprotective activity- The methanolic extract of dried flowers of *M. ferrea* (100 and 200 mg/kg) was screened for *in vivo* antioxidant and hepatoprotective activity in experimental female wistar mice.

Antispasmodic activity- The petroleum extract of *M. ferrea* seed oil was evaluated for antispasmodic activity on isolated rat ileum *in vitro*.

Analgesic activity- n-Hexane, ethyl acetate and methanol extracts of *M. ferrea* leaves (125 and 250 mg/kg) exhibited significant analgesic activity in acetic acid induced writhing response in mouse.

Antispasmodic activity- The petroleum extract of *M. ferrea* seed oil was evaluated for antispasmodic activity on isolated rat ileum *in vitro*.

Anti-venom activity- The aqueous extract of *M. ferrea* leaves was screened for its activity against fibroblast cell lysis after *Hetero metrus laoticus* scorpion venom treatment. Viability of fibroblast cells after 30 min treatment with mock control or with 0.706 and 0.406 mg/ml showed efficiency in protecting against venom induced lysis (Uawonggul *et al.*, 2006).

Anti-neoplastic activity- The crude ethanolic extract of *M. ferrea* was evaluated against human cholangiocarcinoma (CL-6), human laryngeal (Hep-2), and human hepatocarcinoma (HepG2) cell lines *in vitro*. The extract showed promising activity against cholangio carcinoma (CL-6), with survival of less than 50% at the concentration of 50 µg/ml. There was potent cytotoxic activity against Hep-2 and HepG2 also (Mahavorasirikul *et al.*, 2010).

The methanolic extract was evaluated against Ehrlich Ascites carcinoma in mice. There was significant inhibition in tumour growth inhibition (Rana *et al.*, 2004). Muthu Marunthu, a poly herbal formulation containing *M. ferrea* flowers (100 mg) was evaluated for antitumour effect on experimental fibrosarcoma in rats. Significant reduction in the levels of DNA and RNA was noticed after Muthu Marunthu treatment.

Immunomodulatory activity- A poly herbal formulation, ACCII containing *M. ferrea* flower buds was evaluated for immunomodulation effect on radiation induced immunosuppression. There was a significant increase in the amount of circulating antibody in animals treated with ACCII (250 mg and 1 g/kg).

Anti-convulsant activity- The ethanolic extract of *M. ferrea* flowers was evaluated for anticonvulsant activity at 3 different dose levels (200, 400 and 600 mg/kg p.o.) by Maximum electroshock seizure (MES) test using albino mice. The extract reduced the duration of Hind limb tonic extension (HLTE) in a dose dependent manner against MES model. The ethanolic extract of *M. ferrea* inhibited MES-induced convulsions. The percentage inhibition achieved at the doses 200, 400, and 600 mg/kg were 100% ($p < 0.01$), 60% ($p < 0.01$) and 100% ($p < 0.001$), respectively. Data from this study showed that *M. ferrea* flowers significantly increased the onset time and decreased the duration of seizures by electroconvulsive shock (Tiwari *et al.*, 2012). **Gross behavior-** Xanthones from *M. ferrea* were screened for their effect on gross behaviour in mice in a dose of 10, 25, 50, 100, 200 and 500 mg/kg. Gross behavioural changes were recorded at 15, 30, 60 and 120 min. All the xanthones of the *M. ferrea* produced signs of CNS depression characterised by ptosis, sedation, decreased spontaneous motor activity and loss of muscle tone. The CNS depressant effect was predominant at the dose level of 200 mg/kg.

3.18. Traditional uses in other systems of medicine

- The plant is used in inflammation and septic conditions (Rai *et al.*, 2000).
- The tribals of Assam use this plant for its antiseptic, purgative, blood purifier, worm control, tonic properties (Parukutty *et al.*, 1984).
- In Thai traditional medicine, it is used to treat fever, cold, asthma and as carminative, expectorant, cardiotonic, diuretic and antipyretic agent (Foundation of Resuscitate and Encourage Thai Traditional Medicine, 2005).
- The ashes of leaves are used for sore eyes. Kernels are used to poultice wounds and in skin eruptions (Burkill, 1966; Kumar *et al.*, 2006).
- Leaf and flower are antidotes for snake bite and scorpion sting. The fixed oil is used for cutaneous infection, sores, scabies, wounds and rheumatism. The flower is stomachic, expectorant and astringent. The decoction or infusion or tincture of bark and roots is a bitter tonic and useful in gastritis, bronchitis (Sahni, 1998; Husain *et al.*, 1992; Joy *et al.*, 1992; Nadkarni, 1976) and to cure snake bite (Santamaría, 1978).
- The aerial parts are Chorionic villus sampling (CVS) active, spasmolytic, diuretic, (Husain *et al.*, 1992; Joy *et al.*, 1992), abortifacient (Nath *et al.*, 1992) and used in fever, dyspepsia, renal disorders and in cosmetics (Kumar *et al.*, 2006).
- In Unani system, the drug is an ingredient of large number of recipes like, "Jawarish Shehryaran" a stomach and liver tonic, "Hab Pachaluna", an appetizer, "Halwa-i-supari pack" a general tonic (Joy *et al.*, 1992; Thakur *et al.*, 1989).
- In north Canada the oil of the seeds is used as an embrocation in Rheumatism and found useful in the treatment of itch (Kirtikar K R *et al.*, 1935).

3.19. Other uses

- It is known for shade creation and radiation modification in improving human thermal comfort (Shahidana *et al.*, 2010).
- The seed oil is substitute for petroleum gasoline, the fraction distilling between 200 and 300°C may be used as fuel for diesel engines (Konwer *et al.*, 1984; Kallappa *et al.*, 2003).
- The polymers obtained from seed oil are used in the preparation of resins (Dutta *et al.*, 2004; Mahapatra *et al.*, 2004, 2007; Dutta *et al.*, 2005, 2006; Das *et al.*, 2010).
- Aqueous leaf extract is used to prepare silver nano particles (Konwarh *et al.*, 2010).
- The seeds are burnt like candles, the wood is used for golf club heads, flowers and stamens are used to stuff pillows for the brides bed (Sahni, 1998).

- Nahar (*M. ferrea*) or *Kesar oil* which is extracted directly from the seeds was investigated for its potential as natural disinfectant and disinfection kinetics. The plant exists popular to the market for its oil production from Seeds kernel, which forms 53-73 percent of the weight of seeds (150-200 seeds weigh per pound).

4. Conclusion

Mesua ferrea Linn. (*Nagakesara*) is an important medicinal plant with a long history of therapeutic use in *Ayurveda*. Classical Ayurvedic texts highlight the medicinal value of its stamens and describe its pharmacological attributes through *Rasapanchaka*, which explains its effectiveness in various disease conditions such as *Atisara* (diarrhea), *Raktapitta* (bleeding disorders), *Arsha* (hemorrhoids), *Jwara* (fever), and *Kushta* (skin diseases). The traditional descriptions of *Kashaya*, *Tikta rasa* along with *Ushna veerya* and *Katu vipaka* suggest its role in pacifying aggravated *Kapha* and *Pitta doshas* and maintaining physiological balance. Modern phytochemical and pharmacological studies provide scientific support for many of these classical claims. The presence of bioactive compounds such as flavonoids, xanthenes, tannins, phenolic compounds, and essential oils contribute to its diverse biological activities, including antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, and anti-ulcer effects. These findings demonstrate that *Nagakesara* possesses significant therapeutic potential and may serve as a valuable source for the development of plant-based medicines. The correlation between traditional Ayurvedic knowledge and contemporary scientific research emphasizes the importance of integrating classical wisdom with modern biomedical approaches. Despite promising experimental evidence, there remains a need for detailed pharmacognostical studies, quality standardization, and well-designed clinical trials to establish its safety, efficacy, and dosage parameters. Such research will help strengthen the evidence base for *Nagakesara* and support its inclusion in modern integrative healthcare systems. Overall, *Nagakesara* represents a valuable medicinal resource with significant therapeutic potential, and further scientific exploration may contribute to the development of safe and effective herbal formulations for the management of various diseases.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that they have no conflict of interest.

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