

PHARMACOGNOSTICAL STUDY OF NAGAKESHARA (*MESUA FERREA* LINN) - AN INGREDIENT IN VYAGHRIHAREETAKI AVALEHA

C Roshy Joseph^{*}, Ilanchezhian R, Patgiri Biswajyoti, CR Harish
Institute for Postgraduate Teaching and Research in Ayurveda, Gujarat Ayurved University, Jamnagar,
Gujarat, India

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ABSTRACT

Herbs are staging a come-back and the herbal renaissance is “the happening” all over the globe. Ironical fact – Ayurvedic System of medicine is still struggling to reach the heights beyond numerous hurdles in its path. One such hurdle is controversy over botanical identity of drugs. Among the many drugs under controversy the drug nagakeshara is also one. The drug nagakeshara is found as an ingredient in many of the Ayurvedic formulations. Nagakeshara is an ingredient in Vyaghrihareetaki Avaleha, used commonly to cure many diseases like shwasa, kasa, pinasa etc. *Mesua ferrea*, *Ochrocarpus longifolius*, *Calophyllum inophyllum*, *Cinnamomum tamala*, *Dillenia pentagyna* are the divergent source plants of nagakeshara. Unripe buds of *Ochrocarpus longifolius* Benth & Hook are sold in the name of rattan nagakeshara. Identification of original drug is the first step to maintain the quality of the final product. Here an attempt was made to study the drug Nagakeshara (*Mesua ferrea*) conceptually, pharmacognostically and analytically. Derived morphological characters with the help of synonyms as per various Ayurvedic classics, one can arrive at a conclusion that the drug should be the stamens present in the flowers of *Mesua ferrea*. In API, *Mesua ferrea* is considered as authentic drug for Nagakeshara.

KEYWORDS: *Mesua ferrea*; Nagakeshara; Pharmacognostical; Physico-chemical.

*** Address for correspondance**

Dr. Roshy Joseph.C.,
Ph.D. Scholar,
Dept. of Rasashastra & Bhaishajya Kalpana,
Institute for Post Graduate Teaching & Research in Ayurveda,
Gujarat Ayurved University,
Jamnagar - 361008,
Gujarat, India.
E.Mail – ayurilan@yahoo.com

INTRODUCTION

Identification of original drug is the first step to maintain the quality of the final product. Ironical fact – Ayurvedic System of medicine is still struggling to reach the heights beyond numerous hurdles in its path. One such hurdle is controversy over botanical identity of drugs.

Nagakeshara is one among the cathurjata¹. The drug nagakeshara is found as an ingredient in many of the Ayurvedic formulations² especially as prakshepa in various avaleha kalpanas like vyaghrihareetaki avaleha³ etc and sandhana kalpanas like dasamoolarishta⁴ etc, and as an ingredient in various other dosage forms like churnas⁵, vati, rasa preparations like mahakaleshwara rasa⁶ etc. The various substitutes and adulterants⁷ in the market are *Calophyllum inophyllum* Linn., *Myristica fragrans* Houtt. etc. In markets of Gujarat & Bombay, unripe buds of *Ochrocarpus longifolius* Benth & Hook are sold in the name of rattan nagakeshara. Unripe fruits of *Cinnamomum tamala* Nees & emberm or *Cinnamomum wightii* are sold as Kala Nagakeshara. Nagakeshara sold in the market of South India is reported to be fruits of *Dillenia pentagyna* Roxb. (Malabar Nagakeshara), Nattu Nagakeshara used by Siddha/Tamil vaidyas resembles to *Cinnamomum wightii*. Buds of *Mammea suriga* Kost. and *Calophyllum inophyllum* Linn are also reported to be used as adulterants. Derived morphological characters with help of synonyms as per various classics, one can arrive at a conclusion that the drug should be the stamens present in the flowers of *Mesua ferrea*.

Reasons behind controversy

- ✓ Confusion in vernacular names.
- ✓ Mentioning of numerous paryayas and niruktas in ayurvedic texts.
- ✓ Absence of clear and descriptive morphological explanation of the plants in our texts.
- ✓ Lack of knowledge about the authentic plant.
- ✓ Non-availability of authentic plants.
- ✓ Profiteering motives of man

MATERIALS AND METHODS

CONCEPTUAL STUDY

References of the drug in various classics

Brhathrayees

- In Charaka samhita the drug is mentioned in kalyanaka ghrita⁸
- In Sushruta samhita⁹ the drug is mentioned under eladi gana, vachadi gana, anjanadi gana priyangvadi gana.
- Ashtanga sangraha the drug is mentioned Eladi gana¹⁰

Nighantus

- **Dhanvantari:** the drug is mentioned under shatapushpadi varga
- **Rajanighantu:** the drug is mentioned under Chandanadi gana
- **Bhavaprakasha:** the drug is mentioned under karpooradi gana
- **Shaligrama:** the drug is mentioned under karpooradi varga

Synonyms

- Punnaga - It denotes Gender, mentioned for its best qualities among the trees.
- Kesar - Its useful part strikeshara (stigma).
- Deva vallabha - It has beautiful, fragrant flowers and it is admired by the Gods so called deva vallabha.
- Naga pushpa - This flowers fragrance like hastimada, so it is called as nagapuspha.
- Naga kesara - Its kesara (stamens) liked by snakes so it is called nagakeshara.¹¹

Synonyms mentioned in various nighantus are compiled in **table 1**.

Regional names

Assam	-	Nageshwar
Bengali	-	Nagesvara, Nagesar
English	-	Cobra's saffron

Gujarati	-	Nagakesharaa, Sachu Nagakesharaa, Nagchampa, PilaNagkeshara, Tamranagkear.
Hindi	-	Nagakesharaa, Pila Nagakesharaa
Kannada	-	Nagsampige, Nagakesharai
Malayalam	-	Nangaa, Nauga, Peri, Veluthapala, Nagppu, Nagappouu
Marati	-	Nagakesharaa
Oriya	-	Nageswar
Punjabi	-	Nageswar
Tamil	-	Naugu, Naugaliral, Nagachampakam, Strunagappu
Telugu	-	Nagachampakamu
Urudu	-	Narmushk, Nagakeshara ¹²

Geographical source

It is disturbed in Mountains of eastern Himalaya and East Bengal, Assam, Tenasserim Burma, Andamans, evergreen rain forests of North Kanara and South Konkan, forests of the Western ghats from South Kanara to Tranvancore¹³.

Plant description: *Mesua ferrea* Linn

Evergreen trees, 20-30 m tall, often buttressed at base sap-wood creamy white or pinkish brown; heart-wood dark red, extremely hard, bitter and sweet scented; bark smooth, ash-colored, grey, turning dark-brown; white flakes branch lets slender, terete; leaves opposite, decussate, linear, lanceolate, oblong-lanceolate or elliptic-oblong obtuse or acute at base, acuminate or cuspidate at apex rigidly coriaceous, glabrous, shiny above and generally covered with a wax-like white powder beneath; Flowers often showy, white, yellow or red, sometimes polygamo-dioecious, sepals 2-6, imbricate or in decussate, petals 2-6 usually much imbricated. Fruit ovoid to globose with a conical point, striate, 1-10 loculed, 1-4 seeded.

Useful parts - Fruits, seed, Flowers, Buds, Leaves, Bark,

Part used: Stamens¹²

Chemical Constituents

- Nagakeshara contains mesuol 1 %¹⁴
- Flowers contain essential oil and oleo resin.¹²
- Two bioflavanones designated as mesuaferrone-A and mesuaferrone - B have been reported from the stamens¹⁵
- Other chemical constituents isolated from it are mesuol, mesuaferrol, leuco anthocyanidin, mesuone, mammeigin, mesuagin, euxanthone, etc. presence of xanthone derivative - ferruol A & B, a triterpene named guttiferol, ferraxanthone derivative and essential oil have been also been reported from various parts of the plant.¹⁵

Rasapanchaka

Rasa	-	Katu, Tikta, Kashaya
Guna	-	Ruksha, Laghu
Veerya	-	Ushna
Vipaka	-	Katu ¹²

Rasapanchaka of Nagakeshara according to different Ayurvedic texts are mentioned in **table 2**.

Karma

Vedanasthapan, Durgandhanashana, Svedapanayan, Uttejak, Mastishkbalya, Deepan, Pachan, Trishnanigrahana, chardinigrahan, Arshoghna, grahi, Krimighna, Hridya, Shonitasthapan, Kaphaghna, Vajikaran, Mutrajanan, Kusthaghna, Jvaraghna, Vishaghna, Balya¹⁶.

Pharmacological Actions

Mesuol & mesuone two phytoconstituent of Nagkeshara, showed antibiotic activity, mesuol was more active than mesuone against *Mycobacterium phlei*.¹⁴

Ethanollic extract of whole plant excluding root showed antibacterial activity. Other pharmacological activities reported are: antifungal, anthelmintic, hypotensive, antispasmodic, antianaphylactic, antiasthamatic, antiimplantation, anti-inflammatory juvenominetic, insecticidal etc.

Toxicological activity

The LD₅₀ of ether extract of whole plant in mice is 500mg/kg IP, LD₅₀ of acetone extract of stamens in mice was 400 mg/kg iv & non toxic up to 1600 mg/kg P.O.¹⁵

Therapeutic uses

Nagakeshara is hot, dry, digestive, good for fevers, sweats, foul breath, scabies, skin eruption, itching, small tumors, headache, blood & heart troubles, sore throat, cough, hiccough, vomiting, thirst, dysentery & bleeding piles.

The leaves & flowers in combination with other drugs are recommended for the treatment of snakebite & scorpion sting¹³.

Important formulations

Chandanabalalakshadi Taila, Kumaryasava, Nagakesharadi Churna, Haridra Khandā¹².

Dose: 1-3 gm of powder¹²

Divergent source plants of nagakeshara

- 1 - *Mesua ferrea*
- 2 - *Ochrocarpus longifolius*
- 3 - *Calophyllum inophyllum*
- 4 - *Cinnamomum tamala*
- 5 - *Dillenia pentagyna*

Derived morphological characters of nagakeshara with the help of synonyms

- ✓ Large tree
- ✓ Flowers are fragrant with hooded petals
- ✓ Stamens – numerous and golden yellow in colour.
- ✓ Fruit is pitcher shaped

1. *Mesua ferrea* - Family - Clusiaceae

This is the most accepted source of nagakeshara and considered to be the original source. (Plate 1)

2. *Ochrocarpus longifolius* - Family - Clusiaceae

Dried flower buds are considered as “ratun Nagakeshara”.

3. *Calophyllum inophyllum* - Family - Clusiaceae

Stamens are sold as Nagakeshara.

Other species- *C. elatum*, *C. apetalum*.

4. *Cinnamomum tamala* -Family - Lauraceae

Unripe fruits sold in the markets as “karu Nagakeshara” and siddha & tamilnad vaidyas use it in the name of “nattu Nagakeshara”/sirunagappu.

5. *Dillenia pentagyna* - Family - Dilleniaceae

Unripe fruits are used under the name – “malabar Nagakeshara” in malabar and madras.

Other species: *D.indica*.

The derived morphological characters of nagakeshara (with the help of synonyms) is compared with *Mesua ferrea*, *Ochrocarpus longifolius*, *Calophyllum inophyllum*, *Cinnamomum tamala*, *Dillenia pentagyna* are shown in table 3.

The karma of Nagakeshara is compiled from various Ayurvedic texts and compared with *Mesua ferrea*, *Ochrocarpus longifolius*, *Calophyllum inophyllum*, *Cinnamomum tamala*, *Dillenia pentagyna* is mentioned in table 4.

COLLECTION OF DRUG

Flowers of the tree *Mesua ferrea* were collected from the source place koppa (12° 33'0" N, 75° 21'0" E12.55, 75.35), Karnataka, India. The flowers were dried in shade and the stamens were collected. The stamens were authenticated and voucher specimen preserved in the department. The dried stamens were studied for pharmacognostical evaluation, including examination of morphological and microscopic characteristics and physicochemical evaluation.

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Description of part used - Stamens

Macroscopy

Stamen consists of anther and connecting filament, coppery or golden brown, filament united at base forming a flesh ring, each stamen 0.9-1.9 cm long, anther about 0.5 cm long, linear, basifixed, containing pollen grains, filament 0.8 cm long, slender, filiform, more or less twisted, soft to tough, quite brittle, connective not visible with naked eye, odor, fragment, taste, astringent.

Microscopy

Androecium - Anther shows golden brown, longitudinally dehiscent anther wall, consisting of thin walled, parenchymatous cells, pollen grains numerous in groups or in single, yellowish and thin walled, many pollen grains having 1-3 minute, distinct protuberances on walls, thick walled, exine and intine distinct.

Powder microscopy

Powder - Brown; shows elongated cells of filament, connective and numerous golden yellow pollen grains having 1-3 protruberances¹².

Organoleptic characters of Nagakeshara powder

Colour :	Brown
Odour :	Characteristic
Taste :	Astringent
Texture :	Smooth

Diagnostic characters

The following characters of Nagakeshara powder were observed under the microscope.

(Plate 2)

- Pollen grains having 3 proturbances
- Pollen mass
- Epidermal cells
- Colouring matter (yellowish brown)
- Trichome

ANALYTICAL STUDY

Physico chemical Parameters:see table 5.

All the values obtained were compared with that prescribed in API and found within the prescribed limits.

DISCUSSION

Identification and collection of the genuine drug is the first step to maintain the quality of the final product as well as to get the desired therapeutic actions. Nagakeshara is one of the ingredients of vyaghrihareetaki avaleha, which is a commonly used compound formulation in shwasa and kasa. Unripe buds of *Ochrocarpus longifolius* Benth & Hook are sold in the name of rattan nagakeshara. As per the meaning of the word nagakeshara, it is very clear that keshara (stamens) are the useful part. But unripe buds of *Ochrocarpus longifolius* Benth & Hook are too small to find out the stamens in it. Unripe fruits of *Cinnamomum tamala* Nees & emberm or *Cinnamomum wightii* are sold as Kala Nagakeshara. Derived morphological characters (Table 3) with help of synonyms (Table 1) as per various classics, one can arrive at a conclusion that the drug should be the stamens present in the flowers of *Mesua ferrea*. *Mesua ferrea* – satisfies most of the characters of nagakeshara as mentioned in classics hence considered as original plant source of nagakeshara. *Ochrocarpus longifolius* and *D.pentagyna* has some of the properties and actions (Table 4) similar to that of nagakeshara. Useful parts of *C.Inophyllum* are bark, leaves, seed oil. No mentioning of flowers being used medicinally (Table 4). Useful part of *C.tamala* is leaf and fruit and no mentioning of stamens as a useful part. Therefore *C.Inophyllum* and *C.tamala* are mainly used as adulterants.

CONCLUSION

- ✓ *Mesua ferrea* is the original plant source for nagakeshara.
- ✓ Mass cultivation of original plant source becomes necessary to avoid entry of adulterants and substitutes into the system
- ✓ *Mesua ferrea* is under the list of endangered species
- ✓ It's time to take crucial steps towards resolving the controversies which is posing a great threat in ensuring the genuineness of the raw drugs

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Table 1: Synonyms mentioned in various nighantus

Synonyms	DN	KN	MN	BPN	RN
Nagakesara	+	+	+	+	+
Nagapushpam	+	+	-	+	-
Nagam	+	-	+	+	-
Kesara	+	+	+	+	-
Chaampeya	+	+	+	+	+
Kanaka	+	+	-	-	+
Hema	-	-	-	-	+
Nagakinjalka	+	+	-	+	+
Ahipushpam	-	+	-	-	-
Nagarenuka	-	+	-	-	-
Hemabham	-	+	-	-	-
Gajam	-	-	+	-	-
Kanchanahvaya	-	-	-	+	-
Rajapushpa	-	-	-	+	-
Konakahriyaa	-	-	-	+	+
Kinjithakam	-	-	-	-	+
Suvana	-	-	-	-	+
Nagiyam	-	-	-	-	+
Rukma	-	-	-	-	+
Homakanjanam	+	-	-	-	-
Nagahram	-	+	-	-	-

“+” Present; “-“ Absent

Table 2: Rasapanchaka of Nagakeshara according to different Ayurvedic texts

Texts	Rasa		Guna			Veerya	Vipaka
	Tiktha	Kashaya	Laghu	Ruksha	Tikshna	Ushna	Katu
BPN ¹¹	-	+	+	+	-	+	-
DN ¹⁷	+	-	+	-	-	+	-
RN ¹⁸	+	-	+	-	-	+	-
MN ¹⁹	-	-	+	+	-	+	-
KN ²⁰	-	+	+	+	+	+	-
PVS ¹⁶	+	+	+	+	-	+	+

“+” Present; “-“ Absent

Table 3: Comparing the Morphological Characters of Nagakeshara

Morphological Characters	<i>Mesua ferrea</i>	<i>Ochrocarpus longifolius</i>	<i>Calophyllum inophyllum</i>	<i>Cinnamomum tamala</i>	<i>Dillenia pentagyna</i>
Large tree	+	+	-	-	+
Flowers fragrant	+	+	+	-	-
Petals hooded	+	+	+	-	-
Numerous stamens and golden coloured	+	+	+	-	-
Fruit pitcher shaped	+	+	-	-	-

“+” Present; “-“ Absent

Table 4: Comparing the Karma of Nagakeshara

Karma	<i>Mesua ferrea</i>	<i>Ochrocarpus longifolius</i>	<i>Calophyllum inophyllum</i>	<i>Cinnamomum tamala</i>	<i>Dillenia pentagyna</i>
Aamapachana	+	+	A	π	+
Varnya	+	-	α	π	-
Dourghandyahara	+	+	α	π	-
Vishaghna	+	+	α	π	-
Jvaraghna	+	-	α	π	+
Sthambhana in raktaarshas, pradara, atisaara	+	+	α	π	+

“+” Present; “-“ Absent

 α - Useful parts are bark, leaves, seed oil. **No mentioning of flowers being used medicinally** π - Useful part is leaf and fruit does not have much medicinal use.**Table 5: Analytical values of physico chemical parameters of *Mesua ferrea***

Sr. No.	Parameters	Value
1	Loss on drying (% w/w)	6.78
2	Ash Value (% w/w)	4.84
3	Acid insoluble ash (% w/w)	2.15
4	Alcohol soluble extractive (% w/w)	19.48
5	Water soluble extractive (% w/w)	15.26

Plate 1 - Nagakeshara - *Mesua ferrea* Linn.



Tree



leaves



Flowers



Fruits



Dried flowers

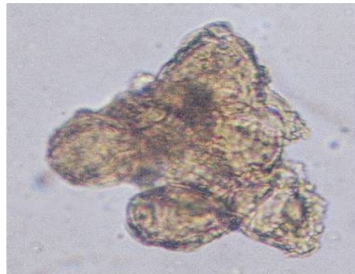


Dried stamens

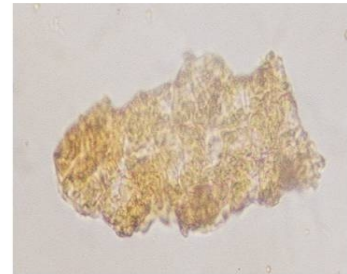
Plate 2 – Microphotograph of *Mesua ferrea* Linn.



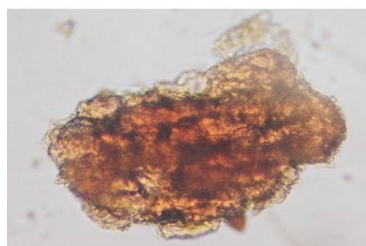
Pollen grains having 3 proturbances 20x



Pollen mass 20x



Epidermal cells 20x



Colouring matter (yellowish brown) 20x



Trichome 40x

Source of support: Nil, Conflict of interest: None Declared