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

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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 Bent & 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 Nagakehara.

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

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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 cathurjata. The drug nagakeshara is found as an ingredient in many of the Ayurvedic formulations especially as prakshepa in various avaleha kalpanas like vyaghrihareetaki avaleha etc and sandhana kalpanas like dasamoolarishta etc, and as an ingredient in various other dosage forms like churnas, vati, rasa preparations like mahakaleshwara rasa etc. The various substitutes and adulterants in the market are Calophyllum inophyllum Linn., Myristica fragrans Houtt. etc. In markets of Gujarat & Bombay, unripe buds of Ocyracarpus 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

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

Nighantus
- Dhanvantari: the drug is mentioned under shatapushpadi varga
- Rajanighantu: the drug is mentioned under Chandanadi gana
- Bhavaprakash: 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.

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, PiluNagkeshara, Tamranagkear.
Hindi - Nagakesharaa, Pila Nagakesharaa
Kannada - Nagasampige, Nagakesharaa
Malayalam - Nangaa, Nauga, Peri, Veluthapala, Nagppu, Nagappouu
Marati - Nagakesharaa
Oriya - Nageswar
Punjabi - Nageswar
Tamil - Naugu, Naugaliral, Nagachampakam, Strunagappu
Telugu - Nagachampakamu
Urdu - Narmushk, Nagakeshara

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 Tranvancore.

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: Stamens

Chemical Constituents
- Nagakeshara contains mesuol 1 %.
- Flowers contain essential oil and oleo resin.
- Two bioflavanones designated as mesuaferrone-A and mesuaferrone - B have been reported from the stamens.
- Other chemical constituents isolated from it are mesuol, mesuaferrol, leuco anthocyanidin, mesuone, mamegein, 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.

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

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

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

Ethanolic 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 LD$_{50}$ of ether extract of whole plant in mice is 500mg/kg IP, LD$_{50}$ 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, hiccup, vomiting, thirst, dysentery & bleeding piles. The leaves & flowers in combination with other drugs are recommended for the treatment of snakebite & scorpion sting.$^{13}$

Important formulations
Chandanabalalakshadi Taila, Kumaryasava, Nagakesharadi Churna, Haridra Khanda$^{12}$.

Dose: 1-3 gm of powder$^{12}$

Divergent source plants of nagakeshara
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 nagakshera (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.
PHARMACOGNOSTICAL STUDY OF NAGAKESHARA - Mesua ferrea

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 protuberances

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 protuberances
- 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 nagakshera, 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 & embern 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

ACKNOWLEDGEMENT

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REFERENCES


*International Journal of Research in Ayurveda & Pharmacy, 1(2), Nov-Dec 2010 264-272*
Table 1: Synonyms mentioned in various nighantus

<table>
<thead>
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<th>Synonyms</th>
<th>DN</th>
<th>KN</th>
<th>MN</th>
<th>BPN</th>
<th>RN</th>
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<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Nagapushpam</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Nagam</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Kesara</td>
<td>+</td>
<td>+</td>
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<td>+</td>
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<td>Hema</td>
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<td>-</td>
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</tr>
<tr>
<td>Hemabham</td>
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<td>Gajam</td>
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<td>+</td>
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<td>Nagahram</td>
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“+” Present; “-” Absent

Table 2: Rasapanchaka of Nagakeshara according to different Ayurvedic texts

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<tr>
<th>Texts</th>
<th>Rasa</th>
<th>Guna</th>
<th>Veerya</th>
<th>Vipaka</th>
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<td>Tikth</td>
<td>Kashaya</td>
<td>Laghu</td>
<td>Ruksha</td>
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<td>BPN¹⁰</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>DN¹⁷</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
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<tr>
<td>MN¹⁸</td>
<td>+</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>KN²⁰</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
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<td>PVS¹⁶</td>
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<td>+</td>
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“+” Present; “-” Absent
Table 3: Comparing the Morphological Characters of Nagakeshara

<table>
<thead>
<tr>
<th>Morphological Characters</th>
<th>Mesua ferrea</th>
<th>Ochrocarpus longifolius</th>
<th>Calophyllum inophyllum</th>
<th>Cinnamomum tamala</th>
<th>Dillenia pentagyna</th>
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<tbody>
<tr>
<td>Large tree</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Flowers fragrant</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Petals hooded</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Numerous stamens and golden coloured</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fruit pitcher shaped</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
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“+” Present; “-” Absent

Table 4: Comparing the Karma of Nagakeshara

<table>
<thead>
<tr>
<th>Karma</th>
<th>Mesua ferrea</th>
<th>Ochrocarpus longifolius</th>
<th>Calophyllum inophyllum</th>
<th>Cinnamomum tamala</th>
<th>Dillenia pentagyna</th>
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<tr>
<td>Aamapachana</td>
<td>+</td>
<td>+</td>
<td>A</td>
<td>π</td>
<td>+</td>
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<tr>
<td>Varnya</td>
<td>+</td>
<td>-</td>
<td>a</td>
<td>π</td>
<td>-</td>
</tr>
<tr>
<td>Dourghandyahara</td>
<td>+</td>
<td>+</td>
<td>a</td>
<td>π</td>
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<tr>
<td>Vishaghna</td>
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<td>+</td>
<td>a</td>
<td>π</td>
<td>-</td>
</tr>
<tr>
<td>Jvaraghna</td>
<td>+</td>
<td>-</td>
<td>a</td>
<td>π</td>
<td>+</td>
</tr>
<tr>
<td>Sthambhana in rakaarshas, pradara, atisaara</td>
<td>+</td>
<td>+</td>
<td>a</td>
<td>π</td>
<td>+</td>
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</tbody>
</table>

“+” 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*

<table>
<thead>
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<th>Sr. No.</th>
<th>Parameters</th>
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<tr>
<td>1</td>
<td>Loss on drying (% w/w)</td>
<td>6.78</td>
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<tr>
<td>2</td>
<td>Ash Value (% w/w)</td>
<td>4.84</td>
</tr>
<tr>
<td>3</td>
<td>Acid insoluble ash (% w/w)</td>
<td>2.15</td>
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<tr>
<td>4</td>
<td>Alcohol soluble extractive (% w/w)</td>
<td>19.48</td>
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<td>5</td>
<td>Water soluble extractive (% w/w)</td>
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Source of support: Nil, Conflict of interest: None Declared