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CONCEPTUAL STUDY ON DRUG NAGKESHAR [MESUA FERREA LINN.]

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ABSTRACT-

The nirukti of word Nagakesara signifies that it is a plant characterized by flowers with hooded petals. Nagakesara is a well-known plant; the reference regarding this drug could be traced out in Vedas. Nagakesara has been explained in Atharva parisista. In Garuda Mahapurana,Nagakesara has been mentioned along with other Oushadi samuha. Nagkesar is a small to the medium-sized evergreen tree and a beautiful flowering indigenous herbal verdure often also adored for its ornamental value. Nagkesar tree grows up to 13 m tall with a wide trunk spreading up to 90 cm in diameter. The tree is recognised all over the world for producing a very hard, and sturdy quality wood. The leaves are narrow, oblong, and deep dark green with an underside that appears whitish. The younger lot of leaves are in hues of yellowish pink. Nagkesar flowers are pearl white and yellow and they bloom after about three to five years of planting. The fragrant white flowers ooze a fabulous fragrance. Its yellow-coloured stamens extracts are used in making perfumes and astringents.

KEYWORDS- *Mesua Ferrea Linn, Traditional Medicine, Rasapanchak, Pharmacological Activities; Phytoconstituents, Uses*

INTRODUCTION TO THE DRUG -

Mesua ferrea (Ceylon Ironwood, Cobras saffron) is a species in the family Crustacea. The plant is named after the heaviness of its timber and cultivated in tropical climates for its form, foliage and fragrant flowers. It is native to tropical Sri Lanka but also cultivated in Assam, Southern Nepal, Indochina and the Malay Peninsula. The National Ironwood Forest is a 238-acre forest in Sri Lanka where Mesua ferrea trees dominate the vegetation. It is the National tree of Sri Lanka. It is said that during King Dappula 1V's period (8^{th} century AD) this forest was created and the remaining trees are the shoots of it. Hence it is considered the oldest man made forest in Sri Lanka. According to botanists this is the only Ironwood forest in the dry zone with wet zone vegetation. Nagakesara is a very well-known plant widely available in all parts of India. References regarding the drug Nagakesara is available in ayurvedic classics. According to the available references, Nagakesara plays a significant role in the treatment of many diseases. We do come across Nagakesara in Brihatrayi texts. From this it is clear that Nagakesara is known during the ancient period itself.

HISTORICAL REVIEW:[1,2]

In Kautilya Arthasastram, the drug has been mentioned along with other drugs. The Description of this drug is mentioned in Samhitas like Charaka Samhita,Susrutha Samhita,Ashtanga Sangraha and Ashtanga Hridaya and also Nighantus like Madanapala Nighantu,Nighantu Adarsha,Raja Nighantu, Bhavaprakasha Nighantu,Shaligrama Nighantu,Kaiyadeva Nighantu, Priya Nighantu etc. Nighantukaras explained Nagakesara in detail. They have explained its medicinal uses along with its morphology and identification features with the help of synonyms. Text books of modern period such as Dravyaguna Vignana by P.V.Sharma and Gyanendra Pandey, The Ayurvedic Pharmacopeia of India, Wealth of India, Ayurvedic Materia Medica and other journals written by recent scholars also Give more of information about the Nagakesara.

SAMHITA PERIOD

1.CHARAKA SAMHITA (2^{nd} B.C)

Achaya Charaka quoted Nagakesara at various places. The references are compiled below.

Table No. 1. Showing references of Nagakesara in Charaka samhita.

SL.NO	REFERENCES TO CONTEXT	SLOKA NO.
1	Content of Chandanadya taila	Chi.3/258
2	Content of Kanakarishtam	Chi.14/162
3	In Visarpa,Nagakesara+other drugs are used	Chi.21/72
4	Preperation of Lajapeya	Chi.14/199
5	In Rakthapitta chikitsa	Chi.4/67
6	Visarpa chikitsa	Chi.21/57
7	Content of Maha padma tailam	Chi.29/632
8	Content of Kalyanaka ghritam	Chi.9/36
9	In Vruna Chikitsa	Chi.25/47
10	Used in Arshas along with Navaneetha	Chi.14/210

2.SUSRUTHA SAMHITA(1000B.C)[3]

Acharya Susruta mentioned Nagakesara under 'VACHADI, ANJANADI, PRIYANGVADI GANA'.The references are compiled below.

Table No.2 Showing references of Nagakesara in Susrutha Samhita:

SL.NO	REFERENCES TO CONTEXT	SLOKA NO.
1	Used in Kapha jwara	Ut.39/187
2	Content of Twagadi panaka	Ut.47/33
3	Explained in Murcha pratishedham	Ut.46/17
4	Used in Pana vibhrama chikitsa	Ut.47/41
5	In Panathyaya Nagapushpa+Maricha+Jeeraka+Twak is used	Ut.47/42
6	Content of Ajeya ghruta	Kal.2/47

7	Explained in Mooshakavisha agadayoga	Kal.5/83
8	Explained under Anjanadi gana	Su.38/41
9	Explained under Vachadi gana	Su.38/26
10	Explained under Priyangvadi gana	Su.38/45

3. ASHTANGASANGRAHA (5th A.D)[4]

Acharya Vagbhata mentioned Nagakesara under 'ANJANADI and ELADI GANA'. The various references of Nagakesara are given below.

Table No.3 Showing references of Nagakesara in Ashtanga sangraha:

SL.NO	REFERENCES TO CONTEXT	SLOKA NO.
1	Mentioned under Anjanadi gana	Su.16/6
2	Mentioned under Eladi gana	Su.16/23
3	Used in Prayogika dhooma	Su.14/7
4	Pittasamana drvya	Su.14/11

4.ASHTANGA HRIDAYAM(7th A.D)[5]

Acharya Vagbhata mentioned Nagakesara under' ELADI GANA'. The various references of Nagakesara are given below.

Table No.4 Showing references of Nagakesara in Ashtanga Hridayam:

SL. NO	REFERENCES TO CONTEXT	SLOKA NO:
1	Mentioned under Eladi gana	Su.15/43
2	Nagakesara and other drugs used in Madatyaya chikitsa	Chi.7/44-45
3	Used along with other drugs in Timira	Ut.13/65
4	Use of Nagakesara in Visha pratishedha adhyaya	Ut.35/24

5	Lepa of Nagapushpa+other drugs in Sarpavisha Chikitsa	Ut.36/63
6	Chaturjatha guna	Su.6/160

KASHYAPA SAMHITA (2 A.D)[6]

Table No.5,Showing references of Nagakesara in Kashyapa Samhita:

SL.NO	REFERENCES TO CONTEXT	SLOKA NO
1	Use of Nagakesara+other drugs in Andhaputana Chikitsa	Chi. 4 /52
2	Use of Nagakesara+other drugs in Chardi due to Pitta	Khi.10/121

HARITA SAMHITA[7]

Table No.6, Showing references of Nagakesara in Harita Samhita:

SL.NO	REFERENCES TO CONTEXT	SLOKA NO
1	Lehya of Nagakesara+other drugs mentioned in raktapitta	10/73
2	Ingredient of Patrakadi kwatha in Arshas	11/32
3	Ingredient of Eladi gudika in Arshas	11 /54
4	Ingredient of Mustadya Vataka in Arshas	11/69
5	Ingredient of Bhallataka guda in Arshas	11/72
6	Use of Nagakesara+other drugs in Chalita garbha Chikitsa	50/5

7.CHAKRADUTTA(11th A.D)[8]

Table No.7 Showing references of Nagakesara in Chakradutta:

SL.NO	REFERENCES TO CONTEXT	SLOKA.NO
1	Ingredient of Sivagutika in Rasayanadhikara	66/175
2	Use of Nagakesara+other drugs in Trushna nivaranam	64/58
3	Ingredient of Kutajadya ghritam in Arshas	5/128
4	Nagakesara is used along with other drugs in Kushta chikitsa	50/30
5	Ingredient of Chandanadya taila in Rajayakshma chikitsa	10/88
6	Ingredient of Lavangadya choornam in Rajayakshma chikitsa	10/19
7	Ingredient of Eladi Taila in Vatavyadi chikitsa	11/99
8	Ingredient of Prasarani taila in Vatavyadi chikitsa	11/228

8. RAJAMARTANDA (11th A.D)[9]

Table No.8,Showing references of Nagakesara in Rajamartanda

SL NO	REFERENCES TO CONTEXT	SLOKA NO
1	Nagakesara choorna in Vandyatva	30/77
2	Ingredient of Kushtadi choorna	33/90
3	Ingredient of Marichadi lepam in Makshika damsam	29/71
4	Ingredient of Manjishtadi lepa in Luta visha	29/73

NIGHANTU PERIOD[10]

The era of nighantu is very much important for the systematic study of drugs.Most of the nighantus explained about Nagakesara.

Dhanwantari Nighantu (10th century A.D)[22]

Dhanwantari nighantu explains Nagakesara under SATAPUSHPADI VARGA and also mentions about different paryayas, its rasa, doshaghnata and rogaghnata.

Madanapala Nighantu(13th century A.D)[11]

Madanapala Nighantu mentions Nagakesara under KARPURADI VARGA and also explains about the karma,doshaghnata and rogaghnata. It also explains about chaturjata guna.

Shodhala Nighantu(13th century A.D)[12]

Shodhala Nighantu grouped this drug under SATAPUSHPADI VARGA. This nighantu explains about the different paryayas.

Kaiyadeva Nighantu(15th century A.D)[13]

Kaiyadeva nighantu mentions this drug under OSHADI VARGA.Kaiyadeva nighantu explains about the different synonyms, its guna,karma and its rogaghnata.It also explains about Chaturjataka guna.

Bhavaprakasa Nighantu: (16th Century A.D) -Bhavamisra mentions this drug under KARPURADI VARGA explains about the paryayas,gunas and karma.

Raja Nighantu (17th Century A.D)[14]

Raja Nighantu mentions this drug under PIPALYADI VARGA explains

about different paryayas,rasa, veerya, doshaghnata and matra. Shaligrama Nighantu Bhooshanam(19th century A.D) Shaligrama Nighantu mentions this drug under KARPURADI VARGA. It also explains about the paryayas.

SYNONYMES-[15]

The drug is represented by stamens of yellowish golden colour and hence the names Kanchanahvaya, Hemapushpa, Kanaka, Suvarna, Hemakinjalka, Hema etc. The drug is liked by Elephants and hence the name Nagakeshara .

The petals of the flower resemble the hood of snake. So, the names Naga,

Nagapushpa, Nagiya, Nagahva

The drug gets the name Keshara due its useful part being Stamens.

The flowers resemble Champeya flowers and hence the name. Also, because it is said to be found on the banks of champa river. The fruits of the drug resemble pot and hence the name Kumbhaphala.

CLASSIFICATIONS [17]

Classification means the grouping of drugs having similar characteristic features, properties and actions. In most of the Nighantus, the groups named according to their first drug belonging to that group like Guduchyadi Varga, Haretakyadi Varga etc.

CLASSIFICATION ACCORDING TO CLASSICS [18]

Table No.9, showing the classifications of Nagakesara according to different

Acharyas-

SL.NO	REFERENCES	CLASSIFICATIONS
1	Dhanwantari nighantu	Satapushpadi Varga
2	Madanapala nighantu	Karpooradi varga
3	Shodhala nighantu	Satapushpadi varga
4	Kayyadeva nighantu	Oshadi varga
5	Bhavaprakasha nighantu	Karpooradi varga
6	Raja nighantu	Pippalyadi varga
7	Saligrama nighantu	Karpooradi varga
8	Priya nighantu	Harithakyadi varga
9	Nighantu adarsha	Nagapushpadi varga

VERNACULAR NAMES-

Table 10 : Showing Vernacular names of Nagakeshara

Indian Languages

Assam	Nahor
Bihar	Nagkeshur
Bengal	Nagesar, nagkesar
Bombay	Nagchampa, thorlachampa
Burma	Gangau, kengau
Canarese	Kanchana, nagakeshara, nagasampige
Ceylon	Naka
Coorg	Atta, irupumara
English	Ceylone iron wood, Ironwood of assam
French	Arbre-de-fer, bios d'anis, bios-de-fer
Hindi	Nagas, nagkesar
Indo-china	Thiet lucmoc, vap
Konkani	Nagachampa
Malay	Matopus, penaga suga
Malayalam	Nagachempakam, nanga, peri, vainavu, vellutachempakam, veluttapala
Marathi	Nagachampa, nagchampa, nagachampha, nagchapha
Nepal	Nagesuri
Persia	Narmishka
Punjab	Nagakesar
Sind	Nakesaru
Tamil	Irul, karunangu, malainangu, mannainangu, naganchambagam, nagappu, nagesuram, nangu, nirnangu, patai, pudangoli, sirunagappu, tadanangu
Telugu	Gajapushpamu, kesaramu, kinjalkamu, nagachampakamu, nagakesharamu, sikatimanu, suvarnamu
Tulu	Kesara, nagasampai

Urdu	Narmishka

Foreign languages

1.English : Ceylon,Iron-wood

2.French : Arbre de fer

3.Indo china : Thiet lucmoc

4.Malay : Matopus

BOTANICAL IDENTITY

Botanical name : Mesua ferrea Linn.

Family Name : CLUSIACEAE

Botanical Synonyms : Mesua coromandel Iana Wight

Mesua pedunculata Wight

Mesua speciosa Chois

Table No.14, Showing Taxonomical classification of Mesua ferrea Linn.

Kingdom	Plantae
Subkingdom	Viridaeplantae
Phylum	Tracheophyta
Subphylum	Euphyllophytina
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Dilleniidae
Superorder	Theanae

Order	Malpighiales
Family	Clusiaceae
Subfamily	Kielmeyeroideae
Tribe	Calophylleae
Genus	Mesua
Species	ferrea Linn.

DISTRIBUTION & HABITAT

Mountains of E.Himalaya and E.Bengal, Assam, Tenasserium, Burma, Andamans, Evergreen forests of N.Kanara and S.Konkan,forests of the W.ghats from S.Kanara to Travancore,up to 5,000 ft.Ceylon.

MORPHOLOGICAL CHARACTERS OF Mesua ferrea Linn

A middle sized,glabrous tree;trunk straight,erect;bark smooth,ash-coloured; young branches twiggy,slender.

Leaves - 7.5-12.5 by 2.5-3.8cm.oblong-lanceolate,acute or acuminate,red when young,afterwards shining above,glaucous and pruinose beneath,rounded or acute at the base and with close,inconspicuous nerves;petioles 6-8mm.long.

Flowers - Very fragrant,2.5-7.5cm. diam,axillary or terminal,solitary or in pairs, subsessile; buds subglobose;bracts 0.

Sepals - 4, orbicular,cupped,puberulous outside,persistent,the inner pair much longer than the outer.

Petals - 4,pure white,spreading,ovate-cuneate,with crisped and undulate margins often torn.

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

Fruit - 2.5-3cm.long, ovoid with a conical point, surrounded by the enlarged sepals; pericarp tough, semi-Woodyear length 2-valved.

Seeds - 1-4, angular, smooth, chestnut-brown.

PHYTOCHEMISTRY

Under this heading, we have to consider all the constituents of a drug. The action of the drug depends upon its constituents[50,51,66]

Table No.15, Showing Chemical constituents of Nagakesara

Stamens	Bark	Heartwood
Biflavanone Mesuaferrone A Xanthones Mesuaxanthone A Mesuaxanthone B Euxanthone B-amyrin B sitosterol Mesuaferol	Mesuabixanthone A,B Betulinic acid Epicatechin 1,6 dihydroxyxanthone 4-alkyl coumarin Ferruol A	Euxanthone Mesuaxanthone A Mesuaxanthone B Euxanthone

Seed	Flower
Lactone mesuol Phenol mesuone Mammeisin	Volatile oil Mesuol Mesuaxanthone A & B

PROPAGATION AND CULTIVATION[20]

It requires well drained, deep, fertile soil. S tiff, clay and low-lying situations are unsuitable. Natural reproduction is generally profuse on account of abundant seeding. It is a strong shade bearer, particularly when young, and this makes it a valuable component of the middle storey forests.

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 6 ft.is recommended. The rate of growth is slow. The tree grows faster after transplantation than that in natural forests. Mesua forests are worked under selection or shelterwood methods.

FLOWERING AND FRUITING

February-April

CONTROVERSIES

In the bazars of Gujarat and Bombay, another kind of Nagakesara is available. It is unripe buds of the flowers of Ochrocarpus longifolia. It is known as' Rutun Nagakesara.'The unripe fruits of Cinnamomum tamala wightii are sold as' Karu nagakesara.'.Dillenia pentagyna fruits known as' Malabar nagakesara'.

SUBSTITUTES AND ADULTERANTS

Calophyllum inophyllum, Cinnamomum Wightii and Myristica fragrans are sold as substitutes for Mesua ferrea. In markets of Gujarat and Bombay unripe buds of

Ochrocarpus longifolius are sold in the name of Ratan Nagakesara. Unripe fruits of Cinnamomum tamala are sold as Kala Nagakesara. Nagakesara sold in bazaars of South India is reported to be fruits of Dillenia Pentagyna(Malabar Nagakesara). Buds of Mammae Suriga and Calophyllum epiphyllum are reported to be used as adulterants.

TOXICOLOGY

The LD50 of ethanolic extract of whole plant in mice was 500mg/kg i.p;LD50 of acetone extract of stamens in mice was 400mg/kg,i.v. and non-toxic up to 1600mg/kg

POSOLOGY

The word Posology is derived from the Greek word "posses" which means how much and logos means science. That means it is a branch of medical science, which deals with doses or quantity of drug, which when administered produce required pharmacological actions.

Choorna - 1-3gms

Decoction – 10-20ml

PROPERTIES:

नागकेशरमल्पोष्णं लघु तिक्तं कफापहम् ।

बस्ति रुग्विषवातास कण्डुघ्नं शोफनाशनम् ॥१०॥

BHAVPRAKASH -

नागपुष्पं कषायोष्णं रूक्षं लघ्वामपाचनम् ।

ज्वर कण्डू तृषा स्वेदच्छर्दि हृल्लास नाशनम् ।

दौर्गन्ध्य कुष्ठ वीसर्प कफपित्त विषापहम् ॥६०॥

भा.प्र.

RAJNIGHANTU-

नागकेसरमल्पोष्णं लघु तिक्तं कफापहम् ।

बस्तिवातामयघ्नं च कण्ठशीर्षरुजापहम् ॥१७८॥

रा.नि.

RASAPANCHAKA

A drug acts by its potency, which implies all the qualities of drugs by which they act,viz Guna, Rasa,Vipaka, Veerya and Prabhava. A drug performs certain local and general actions by its Rasa and Guna and certain specific therapeutic actions by its Vipaka and Veerya.

Table No.11Showing the Rasa Panchaka of Nagakesara according to different acharyas

RASA PANCHAKA		D.NI [22]	M.P.NI [23]	R.NI [27]	K.NI [25]	B.NI [26]	NI.R [67]	NI.A [30]	P.NI [29]
RASA	Kashaya	-	-	-	+	+	+	+	+

	Tikta	+	-	+	-	-	+	-	_
GUNA	Laghu	+	+	+	_	-	+	-	+
	Ruksa	-	+	-	+	+	+	+	_
VIRYA	Ushna	+	+	+	+	+	+	-	+
VIPAKA	Katu	+	-	+	-	+	-	+	_

PANCHABHOUTIKA CONSTITUTION

According to their Rasa Panchaka ,Nagakesara has the following Pancha Bhautika composition.

Table No12. Showing Panchabhautika constitution of the drug

RASA PANCHAKA	PANCHA MAHABHOOTA
RASA	
Kashaya	Vayu + Prithvi
Tikta	Vayu + Akasha
GUNA	
Laghu	Vayu + Agni + Akasha
Ruksa	Agni
VIRYA	
Ushna	Agni
VIPAKA	
Katu	Vayu + Agni

DOSHAGHNATA

Showing the Doshaghnata of Nagakesara according to different acharyas:

Table No.13, Showing Doshaghnata of the drug according to different acharyas:

DOSHAGHNATA	D. NI22	M.P. NI23	R. NI27	K. NI25	B. NI26	Ni. R67	Ni. A30	P. NI29
KAPHAPITTAHARA	-	+	-	+	+	+	+	+
KAPHAHARA	+	-	+	-	-	-	-	-

KARMA

Table No.14, Showing Karma of Nagakesara according to different acharyas:

Karma	D. NI22	M.P. NI[23]	SHO. NI24	K. NI25	B. NI26	R. NI27	SH. NI28	NI. A30	P. NI29
Amapachaka	-	-	-	-	+	-	-	-	-
Deepana	-	-	-	-	+	-	-	-	-
Dourgandyahara	-	-	-	+	-	-	+	-	-
Garbhasthapaka	-	-	-	-	+	-	-	-	-
Kantughna	+	-	-	+	-	-	+	-	-
Raktasamgraha	-	-	-	-	+	-	-	-	-
Sangrahi	-	-	-	-	+	-	-	-	-
Sophahara	+	-	-	-	-	-	-	-	-
Twakdoshahara	-	-	-	-	-	-	-	-	+
Vishahara	+	+	-	+	-	-	+	-	-

THERAPEUTIC USES

Nagakesara has been known and valued as a medicine from olden days. It has been used in the management of various diseases in the following two forms.

1. Bahya prayoga 2. Abhyanthara prayoga

1. **Bahya prayoga :**

- External application of the paste of Manjishta, Nagakesara, Tejapatra and Haridra cures poisonous effects of spider. (R.M.29.31)
- External application of the paste prepared by pounding Maricha,Tagara,Sundi and Nagakesara with water relieves poisonous effects of bee.(R.M.29.23)
- The oil of the seeds is used as an application for rheumatic joints.

- Powder of flower with butter is applied to bleeding piles and for burning sensation of the feet.
- Leaves as poultice applied on forehead in severe colds.

2. **Abhyanthara prayoga:**

- Decoction of the flowers is drunk by women after childbirth.[70]
- Decoction of bark is a bitter tonic and is very useful in gastritis and bronchitis.
- Dried flowers are given in vomiting and thirst.
- Powder of Nagakesara is an excellent drug for checking haemorrhage. (BS Atisara 119)
- For Hiccough, should take Nagakesara mixed with sugar and honey along with juice of sugarcane and Madhuka.(S.S.U 50.23)
- Nagakesara should be taken with buttermilk for 3 days in order to check Leucorrhoea.(BS Stiroga 34)
- Powder of Nagakesara and Aracanut is an excellent formulation to help conception.(BS Striroga 145)
- Women taking fine powder of Nagakesara with cow's ghee during the season keeping on milk diet conceives.(GN 6.5.21)
- By Regular use of Nagakesara butter and sugar the bleeding haemorrhoids go away.

ECONOMIC USES

- The oil is useful in soap making.
- The oleo-resin, which exudes from the base of immature fruits may be diluted with turpentine and used as a varnish.
- Stamens are reported to be used in Malaya for stuffing pillows and cushions.

- Dried flowers, along with other aromatics are used in the preparation of perfumed ointments.
- Heavy wood used for gun- stock, musical instruments and cabinet work.

YOGAS

BHAISHAJYA RATNAVALI

Table No.14, Showing yogas of Nagakesara in Bhaishajya Ratnavali:

YOGAS	Indication	Reference
Babuladya arishta	Atisara	7/171
Bhaskara Lavana	Agnimandya	10/79-87
Chandanadya Tailam	Hikka	16/105-113
Dadimashtaka Choornam	Grahani	8/38
Eladi Choornam	Rajayakshma	14/34
Jeerakadi Modaka	Grahani	8/202-212
Kamadeva Ghritam	Raktapitta	13/145-154
Kudajadya Ghrita	Arshas	9/191
Punarnavadi tailam	Panduroga	12/140-146
Sreekhandasavam	Madatyaya	22/29-33
Talisadi Gutika	Grahani,Gulma	8/118-124
Usheeradi Choornam	Raktapitta	13/40
Vasachandanadya Tailam	Kasa	15/204-210
Vasavaleha	Rajayakshma	14/46-52

pharmacological activities of Mesua ferrea Linn.

a) **Immunomodulatory activity** –

Mesuol isolated from M. ferrea seed oil was evaluated for 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. Constituent showed a significant dose dependent increase in antibody titter and paw volume in humoral and cellular immune response models, respectively. Haematological profile and neutrophil adhesion in rats and phagocytosis in carbon clearance assay also improved demonstrating immunomodulatory activity of mesuol.

b) **Analgesic activity** -

Three extracts of M. ferrea leaves, n-Hexane, ethyl acetate and methanol extracts (125 and 250 mg/kg) exhibited analgesic activity in acetic acid induced writhing in mice. The mesuol exhibited significant inhibition of acetic acid induced writhing in mice in hot plate as well as tail immersion models. The mesuol was also found to reduce the carrageenan induced paw oedema in rats.

C)Antispasmodic activity

In in vitro studies, petroleum ether extract of M. ferrea seed oil inhibited acetylcholine and carbachol induced contractions in rat ileum. The effect was found to be more significant compared to that obtained with atropine.

Antioxidant activity

In in vitro and in vivo experiments, M. ferrea expressed antioxidant activity mediated by inhibition of nitric oxide (NO) and lipid peroxidation. In other in vitro antioxidant studies, ethanolic extracts of stem bark of Mesua ferrea Linn. showed significant radical scavenging activity against

DPPH (89.70%), ABTS (77.64%) and nitric oxide 89.28%.

f) **Anti-venom activity**

The aqueous extract of M. ferrea leaves investigated for their anti-venom activity against Heterometrus laoticus scorpion venom induced fibroblast cell lysis offered protection against venom induced lysis in cells pre-incubated with H. laoticus venom confirming its use against snake bite.

Conclusion

Nagkesar been recognised as one of the prominent herbs in Ayurvedic science since time immemorial for its extensive therapeutic uses. With an array of amazing healing benefits to cure piles, vaginal yeast infection, treat fever, reduce joint pain, protect the heart from cardiovascular disease, enhance digestion, and augment skin health, it is indeed a rich source of many flavonoids with potent analgesic, haemostatic, antibacterial, anti-fungal, antimalarial, anti-arthritic, antioxidant, anti-inflammatory, and antivenom properties that boosts over health and wellbeing.

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