


Review Article
A INTACT REVIEW ON *NELUMBO NUCIFERA* W.S.R TO ITS THERAPEUTIC POTENTIAL
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ABSTRACT

Last few decades have again shown a notable interest in herbal products for food or in medicinal aspect, the reason behind this is the increasing awareness about the limitations of the synthetic agents. *Kamal* is a well known plant in ancient medical sciences. It is extensively described in almost all *Samhita's* and *Nighantu's* of Ayurveda, which reflects its great medicinal value. It has been used extensively by Ayurvedic Physicians for centuries to treat a wide variety of disorders. It is edible used for food and medicine both. *Kamal* is *Nelumbo nucifera* Grertn (syn. *Nelumbium speciosum* Willd.; *Nymphaea nelumbo* Linn.) of Nelumbonaceae family. It is a perennial aquatic herb bearing the famous red lotus flowers. It has miraculous cooling effect and anti-haemorrhagic property. Its flowers contain robinin an glucoside. Leaves contains nuciferine an alkaloid, asmilobine & irinidine. Root contain isoliensinine neferine, seed contains armarparine. The different part contains different chemical constituents which enhance its medicinal value in different diseases. This article review the Ayurvedic literature, traditional uses, phytochemistry & therapeutic reports on different parts of *N. nucifera*. The review also describes various compound isolated from different parts of this plant & the therapeutic benefits derived from those phytoconstituents.

KEYWORDS: Samhita, Nighantu, Anti-haemorrhagic, Glucoside, Alkaloid, Phytoconstituents.

INTRODUCTION

Nelumbo nucifera commonly described as sacred lotus, Indian lotus, Bean of India or simply lotus. It is the National flower of India. It symbolizes divinity, fertility, wealth, knowledge & enlightenment. It is an aquatic plant. Flowers are beautiful, fragrant with numerous petals and stamens^[1]. Water is its life, its habitat is all over the India in lakes & other water sources. Its root is dipped in mud. Vernacular Names^[3-5]

Leaves are shiny, round 30-100 cm in diameter. The plant bear flowers at the height of 30-35 cm having diameter 10-15 cm. *Nelumbo nucifera* is mainly a nutrient, particularly seeds. Seeds have Protein 17.2%, Fat 2.4%, Carbohydrate 66.6%, rather than this it is rich in Calcium, Phosphorus, Iron, Ascorbic acid & Glucose^[2]. Its flowers bloom in morning and close in evening, termed as *Surya - vikashi*.

Table 1: Showing vernacular names of *Kamal*

Hindi	Kamal, Puryin, Kanwal, Kanval
English	Lotus, Sacred lotus, Indian lotus, Chinese water lily
Telugu	Tamara, puvow, Damara, Erratamara, Kaluva, Erra – tamara –veru, Kalung
Mal.	Venthamara, Chenthamara, Senthamara, Thamara
Tam.	Tamarai, Thamaraipoo, Arvindan, Thamarai, Paduman, Kamalam, Sarojam Centamarai, Shivapputamara-ver, Ambal
Bangali	Padama, Padma, phool, Salaphool
Punjabi	Kawal kakri
Marathi	Kamala
Kannada	Tavare, Naidile, Tavaregedd, Tavaribija
Udiya	Padma
Guj.	Kamal, Suriyakamal
Arab.	Nilufer, Ussulnellufir
Assam	Podum

In *Ayurvedic texts*, three varieties are described on the basis of its color viz., red, white & blue. *Kamal* is a

refrigerant, being a brain tonic. It enhances the intellectual power and it promotes sleep. It acts as an astringent in

vomiting, thirst & diarrhoea associated with bleeding per rectum. Its special function is to protect the heart from excessive heat. As it alleviates *Pitta dosha*, it is useful in various bleeding disorders. It is useful in foetal growth. It plays an extraordinary role in urinary disorders caused due to *Pitta*, high grade fever, toxicity, especially in paediatric diseases in which children become weak.

Synonyms^[3,4,6-8]

Table 2: Showing synonyms of *Kamal*

Ambhoruha, Kusesaya & Sarasa	It is an aquatic plant
Pankeruha	The root of which embedded in mud
Padma	The flower is beautiful
Nalina	Its flowers have fragrance
Rajiva	Having numerous stamens
Satapatra & Sahasrapatra	Having numerous petals
Tamarasa	with profuse nectar
Bisaprasuna	Growing from rhizome
Puskara	It is particularly a nutrient especially its seed

- Pandit Narhari, mentioned 34 synonyms of *Kamal* in Raj Nighantu.
- Besides these, there are hundreds of names according to the varieties.

BOTANICAL CLASSIFICATION^[9-11]

Table 3: Showing Botanical classification of *Nelumbo nucifera*

Kingdom	Plantae	Plants
Subkingdom	Tracheobionata	Vascular plants
Super division	Spermatophyta	Seed Plants
Division	Magnoliophyta	Flowering Plants
Class	Magnoliopsida	
Subclass	Magnoliidae	
Super order	Protaenae	
Order	Proteales	
Family	Nelumbonaceae	
Genus	<i>Nelumbo</i>	
Species	<i>N. nucifera</i>	

Binomial name – *Nelumbo nucifera* Gaertn.

Synonyms – *Nelumbium speciosum* Willd., *Nymphaea nelumbo* Linn.

Classical Review

Acharya Charak has mentioned *Kamal* in *Mutraviranjniya Mahakasaya*.^[12] In Susurut samhita, *Kamal* is in *Utapaladi gana*^[13]. Acharya Vagabhat in *Astang sangraha* included *Kamal* in *Mutraviranjniya Mahakasaya*^[14] and in *Astang Hridayam*, *Kamal* is mentioned in *Pittaghna gana*, *Anjanadi gana*, *Priyangvadi gana* & in *Ambashthadi gana*^[15]. Bhavprakash Nighantu

described *Kamal* in *Pushpavarga*^[16]. Raj Nighantu included *Kamal* in *Karviradi varga*^[7]. Kaidev Nighantu has quoted it under *Aushadh varga*^[17]. Dhanvantari Nighantu has described *Kamal* in *Karviradi varga*^[18]. Mahaushadi nighantu included it under *Sammishra varga*^[19]. *Gunaratnamala* described *Kamal* in its forth *Varga Pushpavarga*^[20]. Nighantu Adarsh mentioned *Kamal* in *Kamaladi varga*^[21]. Priya nighantu quoted *Kamal* under *Satpushpadi varga*^[22]. Soursurut nighantu mentioned *Kamal* in *Kakolyadi gana*, *Anjanadi gana* & in *Utpaladi gana*.^[23]

Varieties of *Kamal*

Acharya Bhavmishra mentioned three varieties of *Kamal* on the basis of its color Red, White & Blue which are same in properties. The white variety of *Kamal* is considered to be *Pundareeka*, similarly the red variety is known as *Koknada* & blue variety as *Indivera*. White variety (*Pundareeka*) is superior than other two^[16]. Synonyms of *Pundareeka* are *Shweta patra*, *Sharad* & *shambhu vallabh*. *Pundareeka* is best for *Pitta* & *Rakta dosha*. Synonyms of *Koknada* are *Arunakamal*, *Raktaambhoja*, *Shanpadma*, *Raktoutapal*, *Arvinda*, *Ravipriya* & *Raktavarija*. It is good for *Vata – Pitta – Kapha* & *Rakta* diseases. Synonyms of *Indivera* are *Utapal*, *Neelaabj*, *Neelpankaj*, *Neelpadma*. *Indivera* is best for *rasayana karma* mentioned in Raj nighantu. It is used to make body strong. Rajnighantu mentioned some other varieties also *Padma* is slightly white *Kamal*, light blue *Kamal* is *Utapal* & *Nalin* is slightly red in color. These three varieties are used in vomiting, fainting & heart disease^[24]. Modern classification quoted two varieties white & pink of *Nelumbium nucifera*. Blue is not a variety of *Nelumbium nucifera*, it is specify as lily which is *Kumud* in Ayurvedic literature^[25].

Botanical Description^[16]

Acharya Bhavmishra described term *Padmini* for *Kamal* having all the following parts – root, stem, leaves, fruit & blooming flower. *Padmini* alleviates *Pitta*, *rakta* & *Kapha dosha*. Due to its properties *Sheetal* (cold), *Guru* (Heavy), *Madhura* (Sweet), *Lavana* (salty) and *Ruksha* (dry) *Kamal* aggravates *Vata dosha*. For different parts of *Kamal* different terms described in Ayurvedic texts. Acharya Bhavmishra quoted term *Samvartika* for new leaves of *Kamal*, *Karnika* is for seed case, *Kinjalaka* is for *Kamal kesar*, *Makarand* for *Kamal pushpa rasa*, *Mrinala* & *Bisa* both are used for *Kamal nala* (stem), *Shaluk* is *Kamal Kanda* (rhizome). *Samvartika* (New leaves) is used in painful micturation, piles, epistaxis, heat stroke & thirst. *Karnika* (Seed case) is best in *Rakta*, *Kapha* & *Pitta dosha*. *Kinjalaka* (*Kamal kesar*) has miraculous effect in bleeding piles, poisoning & Inflammation. *Mrinal* (stem) alleviates *Pitta-Rakta dosha*. *Shaluk* have same properties & function as that of *Mrinal*.

MORPHOLOGY

The sacred lotus is a perennial aquatic plant with rhizomes grow in the mud at the bottom of shallow ponds, lakes, lagoons, marshes & flooded fields. It's large peltate (with the leaf - stalk attaching to the centre rather than edge) leaves rise above the water surface on 1-2 m long petioles. Lotus grows a height of about 150cm, with a 3m horizontal spread. The leaves can be as large as 60cm in

diameter, while the showy flower can be upto 20cm in diameter. The fruits are a conical pod, with seeds contained in haies in the pod^[26-28].

Leaves^[29]

Leaves are large of both types aerial as well as floating orbicular 20 – 90 cm in diameter, abruptly acute to form a short tip, petilate, entire glaucous, non-wettable, strong cupped in case of aerial leaves & flat in case of floating ones, radiately nerved, the fresh leaves are leathery, but on drying they are nearly membranous and brittle, there is more or less brownish red blotching on the lower surface. Petioles of the aerial leaves are erect and stout while those of the floating ones are not strong enough. The usual length varies from 24 – 33 cm in case of aerial leaves & 23-30 cm in case of floating. Petioles are smooth, greenish or greenish brown in color with small brown dots. Odour is distinct, fracture is fibrous. When transversely cut the petiole of leaf stalk always shows four distinct, large cavities in the centre & small cavities in the periphery.

Fruits & Seeds^[30]

Fruit is an aggregate of indehiscent nut-lets. Ripe nutlets are ovoid, roundish or oblongish upto 10cm long, 1.5cm broad with hard smooth, brownish or grayish black pericarp which is faintly longitudinally striated, pedunculated & one seeded. Seeds fill in the ripe carpe. Fruits of *N.nucifera* have remarkable power of dormancy & indeed the proved longevity of its seed exceeds that of any known species of flowering plant.

Flowers^[31]

Solitary, large, 10-25cm in diameter, white – pinkish or pinkish white fragrant peduncles arising from the nodes of the rhizomes, sheathing at the base, 1-2 cm long, green or blakish green, hard & stout, smooth or rough due to the presence of numerous small scattered prickles, sepals, petals & stamens are spirally arranged passing gradually once into another.

Rhizomes^[32]

The rhizomes are 60-140 cm long 0.5 – 2.5 cm in diameter, yellowish white to yellowish brown in color, smooth, longitudinally striated with brown patches, nodes and internodes are present. When freshly cut it exudes mucilaginous juice & show a few large cavities surrounded by several large ones. Fracture is tough and fibrous. Odour is indistinct.

Phytochemistry^[33]

N.nucifera commonly known as Lotus and *Kamal* in Hindi belongs to family Nelumbonaceae. Presences of various alkaloids have been reported from the entire plant including nuciferine, neferine, lotusine, isoliensinine, quercetin, isoquercitrin and flavinoids. The seeds of *N.nucifera* contain 2-3% oil comprised of myristic, palmitic, oleic and linoleic acid. Lotus leaf contains several flavonoids and alkaloids, and flavonoids are considered to be one of main components of lotus leaf. A recent study has revealed that eight flavonoids and its glycosides are isolated from lotus leaf, including isorhamnetin, kaempferol, quercetin, quercetin-3-O- β -Dxylopyranosyl-1,2- β -D-glucopyranosyl glycosides, astragalol, chrysoeriol-7-O- β -D-glucoside, isoquercitrin and hyperin. Flavonoids

from lotus leaf receive the greatest attention and are studied extensively, since they were displayed as a remarkable range of biochemical and pharmacological properties. Nor-nuciferine (I), nuciferine (II), remerine, remerine (III) and arnepavine(IV), were isolated from Leaves and petioles. Two serotonin antagonistic alkaloids were isolated from leaves of *N.nucifera* like asimilobine and lirinidine. Both alkaloid inhibited contraction of the rabbit isolated aorta induced by serotonin 10, one more alkaloid nelumbine was also reported to be present in leaves and petioles of the plant which acts as a cardiac poison. The leaves also contain nelumboside, a glycoside which on hydrolysis with 5% H₂SO₄ gave one molecule of quercetin, glucose and glucuronic acid. On methylation with CH₂N₂ followed by hydrolysis this glycoside gave 5,7,3,4-tetra-ortho-methyl-I quercetin. The leaves also contain iso-quercetin, and leucoanthocyanidin which were identified as leucocyanidin and leucodelphinidin by conversion into corresponding anthocyanidin chlorides. Several alkaloids have been isolated from the seeds of *N.nucifera*, The lotus embryo found to contain liensinine (V) and isoliensinine (CI) from one of the formosan lotus. Seeds contained 2.11% oil examined by gas chromatography, urea adduction and UV absorption revealed the presence of myristic acid (0.04%), palmitic acid (17.32%), oleic acid (21.91%), linoleic acid (56.17%) and linolenic acid (6.19%). Fresh rhizomes are analyzed and it contains water – 83.80%, Fat –0.11%, reducing Sugar-1.56%, sucrose – 0.41%, crude protein – 2.70%, starch- 9.25%, fibre-0.80%, ash –1.10%, calcium- 0.06%. The vitamins are reported to be present are as follows (in mg/100g) thiamine – 0.22, riboflavin – 0.06, niacin – 2.1, ascorbic acid – 1.5. The rhizomes also contain asparagines (2%). The oxalate contents of lotus rhizomes were found to be 84.3mg %32.

Distribution^[34]

Warm-temperate to tropical climates, in a range of shallow (up to about 2.5 m deep) wetland habitats, including floodplains, ponds, lakes, pools, lagoons, marshes, swamps and the backwaters of reservoirs. It is widely distributed throughout Eastern Asia. It is native of India, Japan and China. It is found throughout India, extending to N.W. Himalaya, Kashmir, W. Bengal, Central and southern areas of Bihar, Orissa, Maharashtra, in most districts of South India, Especially in the hotter localities.

Cultivation^[34]

Lotus (*Nelumbo nucifera* Gaertn.), one of 12 aquatic species used as vegetable, has been cultivated for more than 2,000 years, and now has been widely cultivated *Nelumbo* grows as an emergent aquatic plant in water up to 2 m in depth at the margins of still lakes or ponds and in slow-moving rivers. It is commonly found growing in ponds and tanks. It is often cultivated for its sweet-scented flowers, edible fruits and rhizomes. The plants are usually propagated by rhizomes and may also be propagated by seeds. Rhizomes, cut into small pieces, are planted with buds above the soil surface in March – April. Care being taken that enough water is retained in the pond or tub till October. If grown from seeds 10 – 12 kg of seeds are enough to get sufficient seedlings for plantation in one hectare. The plant flowers profusely during hot and

rainy seasons and seeds ripen towards the end of rains. It yields approximately 3600 to 4600 kg of rhizomes per hectare, which are ready for harvesting in October.

Ayurvedic Properties and Pharmacological Effect

According to Ayurvedic literature, *Kamal* is *Kasaya* (astringent), *Madhura* (sweet), *Tikta* (bitter) in *Rasa* (taste); *Laghu* (light), *Snigdha* (Unctuousness), *Picchila* (lubricous) in *Guna* (Properties), *Sita* (Cold) in *Virya* (potency), *Madhura* (sweet) in *Vipaka* (metabolism). It is used in *Kapha-Pitta dosha*, *Mutavirajaniya* (discolouration) of urine. Removes worms, allays biliousness, vomiting and strangury^[35].

According to Raj nighantu *Kamal* is *Sheeta* (cold) in potency, *Madhura* (sweet) in taste. It is used in *Raktapitta* (bleeding disorders), *Sharampida* (Tiredness), *Bhram* (dizziness) & *Santap* (fever)^[24].

According to Bhavprakash nighantu, *Kamal* is *Sheeta* (cold) in potency, *Madhura* (sweet) in taste. It cures the diseases of *Kapha* and *Pitta*. It is a good heart tonic & blood coagulant. It is used in *Daha* (burning sensation) it is cooling to the body, allays thirst, *visa* (poisoning) and for local application in skin ailments^[16].

Formulations and Preparations^[34]

Arvindaasava, *Hriberadya taila*, *Ekdasha shatika prasarini taila*, *Mopharva*, *Lakshdya taila*, *Mahachandana taila*, *Raktapittakulakandana rasa*, *Pancharavinda ghrita*, *Brihadgokshuradyavaleha*, *Brihat grahnimihira taila*, *Poogakhanda (apara)*, *Shatavaryadi ghrita*, *Ashwagandha taila*, *Mrinaladi lepa*, *Kamlakesaradiyoga*, *Utpaladi stram*, *Mahapadmaka taila*, *Padma madhu*.

Medicinal Uses^[36]

whole plant is medicinally used, mainly flowers, seeds, tuber and stamens (*Padma kesra*).

Whole plant – removes worms; allays thirst, fever, biliousness, vomiting and strangury.

Root – the root is bitter; it cures cough and biliousness; allays thirst, and is cooling to the body. The powdered root is prescribed for piles as a demulcent; also for dysentery and dyspepsia. It is used as a paste in ringworm and other cutaneous affections.

Stem – it is good in strangury, blood complaints, vomiting and leprosy.

Tender leaves - the tender leaves are bitter, cooling; useful in burning sensation of the body, thirst, strangury, piles and leprosy. The large leaves are used as cool bed sheets in high grade fever.

Flower – it is sweet and cooling; it allays cough, thirst, blood defects, skin eruptions and symptoms of poisoning; good in fever and biliousness; beneficial to the eyes and also recommended as a cardiac tonic.

Anthers – The anthers are cooling, aphrodisiac, astringent to the taste and in diarrhea; remove *Kapha* and *Pitta*; sedative to the uterus; good in thirst, bleeding piles, inflammations and poisoning; cures ulcers and sores of the mouth.

Fruit – it is bitter and astringent, sweet and cooling; removes thirst, blood impurities, *Kapha* and *Pitta*, and foul breath.

Seeds – the seeds are sweet and flavoury, astringent and slightly bitter, aphrodisiac, sedative to the pregnant uterus, destroy *Kapha* and *Vata*, good astringent in diarrhea and dysentery, strengthen the body, useful in burning sensation of body, vomiting and leprosy.

THERAPEUTIC USES

- ❖ The milky viscid juice of the leaf and flower stalks is used in diarrhoea.^[37]
- ❖ The filaments of the lotus are given with honey and fresh butter or with sugar in bleeding piles.^[37]
- ❖ An aqueous extract of the fresh rootstock of the white flowered variety is given internally for snake bite and is believed to be especially useful in the bites of the cobra.^[37]
- ❖ The seed powder of *Kamal* is used with honey, honey is an excellent tonic, removes *Tridosha* and useful in diseases of the eye.^[37]
- ❖ The plant in combination with other drugs is considered an antidote to snake venom (*Charaka*, *Sushruta*, *Vagbhata*, *Sharangdhara Samhita*) and in scorpion venom (*Charaka*, *Sushruta*, *Rasaratnakara*, *Vaidyavinoda*).^[37]
- ❖ The root is diuretic; it is good in throat troubles, chest pain, spermatorrhea, leucoderma and small pox. (Yunani)^[37]
- ❖ The *Kamal* seeds are cool, diuretic, tonic to the uterus, good in menorrhagia and leucorrhoea; useful in fevers and in chest complaints. (Yunani)^[37]
- ❖ The white flower is a good tonic for the heart and the brain; allays thirst; improves watery eyes; good in bronchitis and for internal injuries. (Yunani).^[37]
- ❖ In *Gudabhramsa*, tender leaves of lotus plant must be taken with sugar.^[35]
- ❖ Root of lotus may be chewed in *Krmidanta*.^[35]
- ❖ Stamens of lotus are pounded with rice water and given along with sugar – candy juice in *Balatisara*.^[35]
- ❖ The cold infusion (*Phanta*) with sugar is used for heart strengthening in high grade fever.^[16]
- ❖ when used with *Shweta-rakta chandan*, *Balak*, *Mulethi* and *Mustak* it act as a good heart tonic.^[16]
- ❖ It's cold infusion (*Phanta*) is used to stop bleeding in pregnancy.^[16]
- ❖ *Peya* of *Kamal* seeds is good in vomiting and hiccough. It is used to treat metrorrhagia.^[16]
- ❖ *Churna* (powder) of *Kamal kesar* with sugar is given in treatment of *Raktarsa* (bleeding piles), *Raktapradar* (Metrorrhagia) and *Udharwag raktapitta* (bleeding disorder).^[16]
- ❖ *Peya* of *Kamal kanda* (rhizome) is used in *Atisaar* (diarrhea), *Raktaatisar* (bleeding diarrhea) and in *Kupachan* (indigestion).^[16]
- ❖ Powder of its rhizome is used in piles.^[16]
- ❖ Rhizome of *Kamal* is used as local application in skin ailments.^[16]
- ❖ Goat's milk processed with *Kamal*, *Utpala*, and *Samanga* (*Lajjalu*) or *Mocarasa* or *Sariva*, *Madhuka*, and *Lodhra* or leaf-buds of *Vata* etc. mixed with

honey and sugar is used for drinking, eating and sprinkling anus.^[38]

- ❖ *Utpala*, *dadima* bark and stamens of lotus – these taken together with rice –water alleviates diarrhea associated with fever.^[38]
- ❖ Regular use of butter mixed with sugar and lotus stamens or sasamum, destroys bleeding piles.^[38]
- ❖ One who takes tender leaves of lotus plant mixed with sugar does not suffer from prolapsed of rectum.^[38]
- ❖ Water obtained for lotus ash and mixed with honey alleviates intrinsic haemorrhage.^[38]
- ❖ Powdered lotus stamens mixed with sugar should be taken. It checks haemoptysis.^[38]
- ❖ *Duralabha*, *Parpata* and lotus stalk- these combined or separately pacify intrinsic haemorrhage.^[38]
- ❖ In cough caused by *Pitta*, one should use powder of lotus seeds mixed with honey. It provides relief immediately.^[38]
- ❖ In case of alcoholism, one should take lotus – stalk, lotus- stem, *Pippali* and *Haritaki* mixed with honey, or *Duralabha* or *Musta* with cold water.^[38]
- ❖ Decoction of *Kamal*, *Utpala*, *Srngataka* or *Vidari* or root of *Dandairaka* with cold water in dysuria.^[38]
- ❖ Lotus root cooked in oil mixed with cow's urine should be used in retention of urine associated with severe pain.^[38]
- ❖ Paste of lotus root mixed with cow's ghee is taken in morning. It relieves *Varahadamstra* and fever caused by the same.^[38]
- ❖ Cow's milk alone cooked with lotus (and instilled in eyes) removes redness, haemorrhage, pain, wound, inflammation and *Ajaka*.^[38]
- ❖ Stamens of white lotus pounded with rice-water and mixed with sugar candy checks dysentery immediately.^[38]
- ❖ Ghee processed with the paste of stalk, stem, stamens, leaves and seed of lotus along with piece of gold and milk is known as '*Pancaravinda*' (having five parts of lotus). It promotes strength, virility and intellect.^[38]
- ❖ Powder of blue lotus root and sugar mixed with honey and also sprinkle with cold water. It is soothing and removes pain.^[38]
- ❖ In abortion, leaves of lotus and blue lotus mixed with honey and sugar; taken with milk are useful in miscarriage and abortion.^[38]
- ❖ In case of caries of teeth, one should chew the root of lotus.^[38]

RESEARCH STUDIES

The genus *Nelumbo* is endowed with a number of medicinally important activities antidiabetic, antipyretic, anti-inflammatory, anticancerous, antimicrobial, antiviral and anti-obesity properties^[39]. Furthermore, *N.nucifera* flowers are served as healthy beverages to treat hypertension, cancer, diarrhoea, fever, weakness, infection and body heat imbalance^[40]. It has been widely used in folk

medicine for the treatment of various inflammatory and infectious diseases^[41].

Antidiabetic effects

An ethanol rhizome extract reduced the blood sugar level of normal rats and glucose-fed hyperglycemic and streptozotocin-induced diabetic rats.^[42]

Anti-inflammatory effects

A methanol rhizome extract at dosages of 200 and 400 mg/kg inhibited induced inflammation in rats. The anti-inflammatory activity was comparable with that of phenylbutazone and dexamethasone.^[43]

Antipyretics

The ethanol extract of stalks of *N.nucifera* was evaluated for its antipyretic potential on normal body temperature and yeast induced pyrexia in rats. The stalk extract showed significant activity in both the models at oral doses of 200 and 400 mg/kg. The stalk extract at a dose of 200 mg/kg was found to produce significant lowering of normal body temperature up to 3 h and at 400 mg/kg it caused significant lowering of body temperature up to 6 h after its administration. In the model of yeast provoked elevation of body temperature the extract showed dose-dependent lowering of body temperature up to 4 h at both the doses and the results were comparable to that of paracetamol, a standard antipyretic agent.^[44]

Nootropics

Methanolic extract of rhizomes of *N.nucifera* was found to cause significant reduction in spontaneous activity, decrease in the exploratory behavioral pattern by the head dip and Y maze tests, muscle relaxant activity and potentiating of pentobarbitone induced sleeping time.^[45]

Antiestrogenic effect

Administration of *N.nucifera* to female rats caused estrogen inhibition due to its antiestrogenic nature. The decrease in the weight of ovary and uterus shows antiestrogenic nature of *N.nucifera* since antiestrogenic substance decreases the wet weight of the uterus.^[46]

Effects on lipids and obesity

A Chinese herbal mixture containing sacred lotus reduced serum triglycerides and cholesterol in rats fed a high-fat diet.^[47] An ethanol leaf extracts stimulated lipolysis in visceral and subcutaneous adipose tissues in mice.^[48] The pathway involved the beta-adrenergic receptor mediated in energy expenditure and prevention of diet-induced obesity. The ethanol leaf extract also suppressed body weight gain in mice fed a high-fat diet^[48]. A flavonoid enriched leaf extract reduced blood and liver lipids, lipid peroxidation, release of the liver enzymes AST and ALT, the LDL-C to HDL-C ratio, and lipid accumulation in the liver in a high-fat diet animal model T.^[49,50] The effect of the leaf extract on the high-fat-induced lipid metabolic disorder was comparable with results of silymarin and simvastatin treatment. The flavonoids from the leaf extract may exert antiatherogenic properties by inhibiting vascular smooth muscle cell proliferation and migration.^[51]

Antiplatelet activity

The hydroethanolic extracts of both white and pink *N.nucifera* flowers possess potent antiplatelet activity

limited to primary haemostasis in human blood. The flavonoids present in hydroethanolic extract might have prevented the adhesion and aggregation of platelets besides release of cytoplasmic calcium that stimulates the release of ADP.^[52]

Cytoprotective effects

The lotus root extracts may contain a variety of the antioxidants, such as carotenoids, lipoic acid, uric acid and others, and they may also contribute to the protective effects of these extracts against the iron induced cell death observed here.^[53]

Antianalgesic activity

The methanolic extract of red and white lotus seeds is an effective analgesic agent. While comparing the lotus seed extracts, the white lotus seed at 600 mg/kg body weight revealed higher effect than others.^[54]

Anti-diarrhoeal activity

The methanolic extract of rhizomes of *N.nucifera* showed significant inhibitory activity against Castor oil induced diarrhoea and PGE2 induced enteropooling in rats. It also showed significant reduction of gastrointestinal motility in rats, thus indicating its efficacy as an anti-diarrhoeal agent.^[55]

Immunomodulatory effects

A lotus seed ethanol extract inhibited cell-cycle progression, cytokine gene expression, and cell proliferation in human peripheral blood mononuclear cells (PBMCs).^[56]

Hepatoprotective effects

Ethanol seed extracts exhibited hepatoprotective effects against production of serum enzymes and cytotoxicity caused by carbon tetrachloride. The extract also protected against the genotoxic and cytotoxic effects of aflatoxin B1.^[57]

Antioxidant effects

The *N.nucifera* had potent therapeutic efficacy in modulating erythrocyte function and structural abnormalities by their remarkable hypocholesterolemic and antioxidant property.^[58] Four different chemical analyses document high antioxidant activity from the rhizome knot.^[59]

Anti-infective effects

Ethanol seed extracts inhibited herpes simplex virus type 1 (HSV-1) multiplication in HeLa cells without cytotoxicity by inhibiting gene expression of HSV1.^[60] Alkaloids and flavonoids from a 95% ethanol leaf extract had anti-HIV activity.^[61] Antifungal activity against *Candida albicans* and antimalarial activity was found for various leaf constituents with no observed cytotoxicity.^[62] Antibacterial activity is documented for rhizome extracts against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Bacillus pumilis*, and *Pseudomonas aeruginosa*.^[63] A rhizome extract had antifungal and anti-yeast activity comparable with griseofulvin against 5 different strains of fungi and yeast, including *C.albicaus*, *Aspergillus niger*, *Aspergillus fumigatus*, and *Trichophyllum mentagopyhtes*.^[63]

Psychopharmacologic activity

The alkaloids asimilobine and lirinidine, isolated from the leaves of sacred lotus, inhibited the contraction of rabbit isolated aorta induced by serotonin.^[64] Neferine from lotus seed embryos may have antidepressant activity as indicated by its antiimmobility effects in mice in a forced swimming test.^[65]

Anti-allergic effects

A stamen methanol extract containing kaempferol inhibited key receptors and attenuated immunoglobulin E-mediated allergic reactions.^[66,67]

Antiarrhythmic effects

Neferine antagonized arrhythmias induced by aconitine in rats, calcium chloride in mice, and coronary occlusion-reperfusion in dogs. Neferine's anti-arrhythmic effect may involve blocking human-ether-à-go-go-related gene channels associated with repolarization of the cardiac action potential.^[68]

Antifertility activity

A petroleum ether extract of seed has been reported to possess anti-fertility activity in female albino mice at the dose of 3 mg/kg. It blocked the oestrus cycle at the metoestrus stage compared with ethyl oleate (0.1ml/20g). The extract significantly reduced uterine weight and affected the oestrus cycle by blocking biogenesis of ovarian steroids at an intermediate stage.^[69]

Anti-inflammatory activity

A methanol rhizome extract at dosages of 200 and 400 mg/kg inhibited induced inflammation in rats. The anti-inflammatory activity was comparable with that of phenylbutazone and dexamethasone.^[70]

Other effects

N.nucifera leaf extract inhibits neointimal hyperplasia through modulation of smooth muscle cell proliferation and migration. *N.nucifera* can be considered of therapeutic value in the prevention of atherosclerosis because restenosis after percutaneous transluminal coronary angioplasty can be considered a model of "accelerated atherosclerosis."^[71] Methanolic extracts from the flower buds and leaves of sacred lotus (*Nelumbo nucifera*, *Nelumbonaceae*) were found to show inhibitory effects on melanogenesis in theophylline-stimulated murine B16 melanoma 4A5 cells.^[72]

Substitutes and Adulterants^[34]

Nymphaea alba Linn. And *Nelumbo nucifera* possess somewhat similar medicinal properties and hence can be used in place of each other. Flowers of *Nymphaea* spp. are sometimes adulterated with *N. nucifera*.

CONCLUSION

The Ayurvedic treatment is entirely based on herbs, which have certain medicinal value or property. Ayurvedic herbs that have medicinal quality provide rational means for the treatment of many disease. *Kamal* has lots of medicinal properties, its different parts are used to cure many diseases. This review reflects the importance on *Kamal (Nelumbo nucifera)*, it is used in Ayurvedic medicine from early times for the treatment of various diseases & possess following properties like antidiabetic, antipyretic, anti - inflammatory, anti - cancerous, anti -

microbial, anti-viral and anti – obesity. It is used in vitiated *Kapha-Pitta dosha* & in discolouration of urine. Whole plant removes worms, allays thirst, fever, biliousness, vomiting & stangury. Root is bitter & its paste is used in ringworm & Other cutaneous infections. Stem is used in blood complaints. Tender leaves are bitter, cooling, useful in burning sensation of the body. Its flower is recommended as cardiac tonic. This will also provide valuable information which will help in getting more advanced knowledge about *Kamal* & its variable uses.

REFERENCES

- Priya Vrat Sharma, Namarupajnanam, Chaukhambha Visvabharti Varanasi, Reprint:2011, P.45.
- Priya Vrat Sharma, dravyaguna-Vijnana, Chaukhambha Bharti Academy Varanasi, Reprint: 2009, P.583.
- Dr. J.L.N.Sastry, Dravyaguna Vijnana, Chaukhambha Orientalia Varanasi, Reprint:2015, P.585.
- Priya Vrat Sharma, dravyaguna-Vijnana, Chaukhambha Bharti Academy Varanasi, Reprint: 2009, P.582.
- P.C Sharma, M.B Yeine, T.J.Dennis, Database On Medicinal Plants Used In Ayurveda, Vol 4, CCRAS Janakpuri New Delhi, P.251.
- Prof. K.C. Chunekar, Bhavaprakasa Nighantu, Chaukhambha Bharti Academy Varanasi, edited by Dr G.S Pandey, Reprint:2015,P.466.
- Pandit Narahari, Raj Nighantu, Edited by Dr Indradeva Tripathi, Chowkhamba krishna Das Academy, 4th Edition:2006. P.332.
- Priya Vrat Sharma, Namarupajnanam, Chaukhambha Visvabharti Varanasi, Reprint:2011, P.44,45.
- NODC Taxonomic Code, database (Version 8.0), 1996.
- The Plants Database, database (Version 4.0.4), 2000,National Plant data center, NRCS, USDA.
- The Plants Database, database (Version 5.1.1), 2000, National Plant data center, NRCS, USDA.
- Agnivesha Maharishi, Charak Samhita Vol.1 with elaborated Vidyotini Hindi Commentary by Pt.Kashinatha Shastri, Edited by Dr Gangasahaya pandeya, Published by Chaukhamba Sanskrit Sansthan, Varanasi, Edition Reprint: 2006.P.89
- Sushruta Samhita of Maharshi-Sushruta Part-1, edited with Ayurveda-Tattva Sandipika, commentary by Kaviraja Ambikadutta Shastri, Chaukhambha Sanskrit Sansthan, Varanasi, 2007; 187.
- Kaviraj atridev Gupta, Astanga Samgraha, vol.1, Krishnadas Academy Varanasi, Reprint 1993, P.135.
- Prof P V Sharma, Astangahrdayam, Chaukhambha Orientalia Varanasi, Reprint 2005, P232,235,238.
- Prof. K.C. Chunekar, Bhavaprakasa Nighantu, Chaukhambha Bharti Academy Varanasi, edited by Dr G.S Pandey, Reprint:2015, P.466-469.
- Prof. Priya Vrat Sharma, Kaidev Nighantu, Translated by Dr. Guru Prasada Sharma, Chaukhambha Orientalia, Delhi; 267.
- Prof. Priya Vrat Sharma, Dhanvantari Nighantu, Translated by Dr. Guru Prasad Sharma, Chaukhambha Orientalia, Varanasi, 2005; 145.
- Dr. Indradev Tripathi, Mahaushadha Nighantu of Pt. Aryadasa Kumar Singh, Chowkhamba Vidyabhawan, Varanasi; 182.
- Gunaratnamala of Shri Bhavmishra, Edited with parkas vyakhya by Dr Kailash Pati Pandey, chaukhambha Sanskrit Bhawan Varanasi, 2006, P.133.
- Vaidya Bapalal ji, Nighnatu Adarsa, Chaukhambha Bharti Academy Varanasi, Third edition 2002, vol 1, P.57.
- Prof. Priya Vrat Sharma, Priyanighantu, Chaukhamba Subharti Prakashan, edition 2004, P.90.
- Dr Kashiraj Sharma Suvedi, Dr NarendraNath Tiwari, Sousurut nighantu, Mahendra Sanskrit University Nepal, P. 87, 91, 97.
- Pandit Narahari, Raj Nighantu, Edited by Dr Indradeva Tripathi, Chowkhamba krishna Das Academy, 4th Edition:2006. P.333,334.
- Wikipedia.org [home page on the internet], http://en.wikipedia.org/wiki/Nelumbo_nucifera.
- Banks H. Stafford P. Crane PR. Aperture variation in the pollen of *Nelumbo nucifera* (Nelumbonaceae) Grana,46(3), 2007,157-163.
- Huxley A. Griffiths M. Levy M. The New Royal Horticultural Society Dictionary Of Gardening Macmillan Press, London 3 (LtoQ) 1992, 297-298.
- Shen – Miller J, Mudgett M B, Schopf J W, Clarke S, Berger R. Exceptional Seed Longevity and Robust Growth: Ancient Sacred Lotus From China, American Journal Of Botany, 82(11), 1995, 1367-1380.
- Anonymous, "Pharmacognosy of indigenous Drugs", CCRAS New Delhi, Vol 11, 1982, 806.
- Nagarjun S. Nair, A.G.R Ramkrishnan S. and Subramaniam, S.S., Chemical examination of the flowers of *Nelumbium speciosum* Willd, Current Science, 35(7),1996,176.
- Gupta S.C & Ahluwalia, R.J Indian Botanical Society, 58 (2), 1979.
- Pulok K Mukherjee, R. Bala Subramaniam, Kakali Saha & M. Pal: A Review On *Nelumbo nucifera* Gaertn, Ancient Science Of Life, Vol No. XV, 4 April 1996, P. 268-276.
- Sasi Kumar Dhanarasu & Awdah Al – Hazime, Asian Journal Of Phytomedicine & Clinical Research, 1(2), 2013, 123-136, ISSN- 2321-0915.
- P.C Sharma, M.B Yeine, T.J.Dennis, Database On Medicinal Plants Used In Ayurveda, Vol 4, CCRAS Janakpuri New Delhi, P.256.
- Dr. J.L.N.Sastry, Dravyaguna Vijnana, Chaukhambha Orientalia Varanasi, Reprint:2015,P.586.
- K.R. Kritikar & B.D. Basu, Indian Medicinal Plants, International Book Distributors Dehradun, 2005, vol 1, P.117.

37. K.R. Kritikar & B.D. Basu, Indian Medicinal Plants, International Book Distributors Dehradun, 2005, vol 1, P.118-119.
38. Priyavrat Sharma, Classical Uses Of Medicinal Plants, Chaukhambha Visvabharti Varanasi, Reprint year:2004, P. 79-81.
39. Kashiwada Y, Asoshima A, Ikeshiro Y. AntiHIV benzylisoquinoline alkaloids from leaves of *Nelumbo nucifera* and structure activity correlations with related alkaloids, *Bioorg Med Chem*, 13, 2005, 443-448.
40. Saengkhae C, Arunnopparat W, Sungkhajorn P. Antioxidant activity of *Nelumbo nucifera* Gaertn on oxidative stress-induced Erythrocyte hemolysis in hypertensive and normotensive rats, *J Physiol Sci*, 20, 2008, 70-78.
41. Liu C P, Tsai W J, Lin Y I, Chen C F, Kuo Y C. The extracts from *Nelumbo nucifera* suppress cell cycle progression, cytokine genes expression, and cell proliferation in human peripheral blood mononuclear cells, *Life Sci*, 75, 2004, 699-716.
42. Mukherjee P K, Saha K, Pal M, Saha B P. Effect of *Nelumbo nucifera* rhizome extract on blood sugar level in rats, *J Ethnopharmacol*, 58(3), 1997, 207-213.
43. Mukherjee P K, Saha K, Das J, Pal M, Saha B P. Studies on the anti-inflammatory activity of rhizomes of *Nelumbo nucifera*, *Planta Med*, 63(4), 1997, 367-369.
44. Sinha et al. Evaluation of Antipyretic Potential of *Nelumbo nucifera* Stalk Extract, *Phytother Res*, 14, 2000, 272-274.
45. Mukherjee P K, Saha K, Balasubramanian R et al. Studies on psychopharmacological effects of *Nelumbo nucifera* Gaertn. rhizome extract, *J Ethnopharmacol*, 54, 1996, 63-7.
46. Mukherjee P. Quality control Herbal drugs: an approach to evaluation of botanicals, *Business Horizons*, New Delhi, 1st edition, 2002.
47. La Cour B, Malgaard P, Yi Z. Traditional Chinese medicine in treatment of hyperlipidaemia, *J Ethnopharmacol*, 46(2), 1995, 125-129.
48. Ohkoshi E, Miyazaki H, Shindo K, Watanabe H, Yoshida A, Yajima H. Constituents from the leaves of *Nelumbo nucifera* stimulate lipolysis in the white adipose tissue of mice, *Planta Med*, 73(12), 2007, 1255-1259.
49. Lin M C, Kao S H, Chung P J, Chan K C, Yang M Y, Wang C J. Improvement for high fat diet induced hepatic injuries and oxidative stress by flavonoid-enriched extract from *Nelumbo nucifera* leaf, *J Agric Food Chem*, 57(13), 2009, 5925-5932.
50. Wu C H, Yang M Y, Chan K C, Chung P J, Ou T T, Wang C J. Improvement in high-fat diet induced obesity and body fat accumulation by a *Nelumbo nucifera* leaf flavonoid-rich extract in mice, *J Agric Food Chem*, 58(11), 2010, 7075-7081.
51. Ho H H, Hsu L S, Chan K C, Chen H M, Wu C H, Wang C J. Extract from the leaf of *Nelumbo nucifera* reduced the development of atherosclerosis via inhibition of vascular smooth muscle cell proliferation and migration, *Food Chem Toxicol*, 48(1), 2010, 159-168.
52. Brindha Durairaj, Arthi Dorai. Antiplatelet activity of white and pink *Nelumbo nucifera* Gaertn flowers, *Brazilian Journal of Pharmaceutical Sciences*, 46, 2010, 579-583.
53. Takefumi Sagara, Naoyoshi Nishibori, Manami Sawaguchi, Takara Hiroi, Mari Itoh, Song Her, Kyoji Morita. Lotus root (*Nelumbo nucifera* rhizome) extract causes protective effect against iron-induced toxic damage to C6 glioma cells, *Phytopharmacology*, 2(2), 2012, 179-189.
54. Vikrama Chakravarthi P, Gopakumar N. Evaluation of Analgesic Activity of Lotus seeds (*Nelumbo nucifera*) in Albino Rats, *Veterinary World*, 2(9), 2009, 355-357.
55. Mukherjee P K, Das J, Balasubramanian R et al. Antidiarrhoeal evaluation of *Nelumbo nucifera* rhizome extract, *Indian J Pharmacol*, 27, 1995, 262-4.
56. Liu C P, Tsai W J, Lin Y L, Liao J F, Chen C F, Kuo Y C. The extracts from *Nelumbo nucifera* suppress cell cycle progression, cytokine genes expression, and cell proliferation in human peripheral blood mononuclear cells, *Life Sci*, 75(6), 2004, 699-716.
57. Sohn D H, Kim Y C, Oh S H, Park E J, Li X, Lee B H. Hepatoprotective and free radical scavenging effects of *Nelumbo nucifera*, *Phytomedicine*, 10(2-3), 2003, 165-169.
58. Sasikumar Dhanarasu, Mathi Selvam, Awdah Masoud Al-hazimi, Ramesh T. Physiological and beneficial role of *Nelumbo nucifera* on hypercholesterolemia in rats exposed to cigarette smoke, *Journal of Pharmacy Research*, 5(1), 2012, 425-427.
59. Hu M, Skibsted L. Antioxidative capacity of rhizome extract and rhizome knot extract of edible lotus (*Nelumbo nucifera*), *Food Chem*, 76(3), 2002, 327-333.
60. Kuo Y C, Lin Y L, Liu C P, Tsai W J. Herpes simplex virus type 1 propagation in HeLa cells interrupted by *Nelumbo nucifera*, *J Biomed Sci*, 12(6), 2005, 1021-1034.
61. Kashiwada Y, Aoshima A, Ikeshiro Y et al. Anti-HIV benzylisoquinoline alkaloids and flavonoids from the leaves of *Nelumbo nucifera* and structure-activity correlations with related alkaloids, *Bioorg Med Chem*, 13(2), 2005, 443-448.
62. Agnihotri V K, ElSohly H N, Khan S I et al. Constituents of *Nelumbo nucifera* leaves and their anti-malarial and antifungal activity, *Phytochem Lett*, 1(2), 2008, 89-93.
63. Mukherjee P K, Mukherjee D, Maji A K, Rai S, Heinrich M. The sacred lotus (*Nelumbo nucifera*) phytochemical and therapeutic profile, *J Pharm Pharmacol*, 61(4), 2009, 407-422.
64. Shoji N, Umeyama A, Saito N et al. Asimilobine and lirinidine, serotonergic receptor antagonists, from *Nelumbo nucifera*, *J Nat Prod*, 50(4), 1987, 773-774.
65. Sugimoto Y, Furutani S, Nishimura K et al. Antidepressant-like effects of neferine in the forced

- swimming test involve the serotonin_{1A} (5-HT_{1A}) receptor in mice, Eur J Pharmacol, 634(1-3), 2008, 62-67.
66. Shim S Y, Choi J S, Byun D S. Kaempferol isolated from *Nelumbo nucifera* stamens negatively regulates FcεpsilonRI expression in human basophilic KU812F cells, J Microbiol Biotechnol, 19(2), 2009, 155-160.
67. Toyoda M, Tanaka K, Hoshino K, Akiyama H, Tanimura A, Saito Y. Profiles of potentially antiallergic flavonoids in 27 kinds of health tea and green tea infusions, J Agric Food Chem, 45,1997, 2561-2564.
68. Gu D F, Li X L, Qi Z P et al. Blockade of HERG K⁺ channel by isoquinoline alkaloid neferine in the stable transected HEK293 cells, Naunyn Schmeidebergs Arch Pharmacol, 380(2), 2009, 143-151.
69. Mazumder U K, Gupta M, Pramanik G, Mukhopadhyay R K, Sarkar S. Antifertility activity of seed of *Nelumbo nucifera* in mice, Indian J Exp Biol, 30(6), 1992, 533-534.
70. Mukherjee P K, Saha K, Das J, Pal M, Saha B P. Studies on the anti-inflammatory activity of rhizomes of *Nelumbo nucifera*, Planta Med, 63(4), 1997, 367-369.
71. Rajendra Karki, Eun-Rayee Jeon, DongWook Kim. *Nelumbo nucifera* leaf extract inhibits neointimal hyperplasia through modulation of smooth muscle cell proliferation and migration, Nutrition, 29, 2013, 268-275.
72. Seikou Nakamura, Souichi Nakashima, Genzo Tanabe, Yoshimi Oda, Nami Yokota, Katsuyoshi Fujimoto, Takahiro Matsumoto, Rika Sakuma, Tomoe Ohta, Keiko Ogawa, Shino Nishida, Hisako Miki, Hisashi Matsuda, Osamu Muraoka, Masayuki Yoshikawa. Alkaloid constituents from flower buds and leaves of sacred lotus (*Nelumbo nucifera*, Nymphaeaceae) with melanogenesis inhibitory activity in B16 melanoma cells, Bioorganic and Medicinal Chemistry, 21, 2013, 779-787.

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