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RESEARCH ARTICLE

REVIEW ON PHARMACOLOGICAL ACTIONS OF NYMPHAEA NOUCHALI

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Abstract

Kumud the herb mentioned with different names in Nighantu is one of the herbs useful in Rakta and Pitta Doshas. It is well known herb in ayurveda with many medicinal properties. Blue lotus, red and blue aquatic plant, star lotus, or manel flower are number of the common names for it. It is also called as Indian Blue lotus. It belongs to the southern and eastern parts of Asia, and also known as the national flower of Bangladesh and Sri Lanka. Its Sanskrit name is utpala. It is a well-known herb found in Indian classical text and also used in Siddha medicinal system. Due to its bitter taste, it is widely used in pitta disorders and helps in reducing fever as well as acts as a cooling agent for the body. Many studies showed it hepatoprotective, antioxidant, antidiabetic, DNA protecting activities, antimicrobial activities, analgesic, and anti-inflammatory activities along with its traditional uses. The present review focus on modern pharmacological actions of traditional herb.

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Introduction:-

The Blue waterlily, also called as Indian blue lotus is the water lily found in the Indian subcontinent but it is not a lotus¹. It has blue petals, and the center of the flower is pale yellow. It is described as Nilotpala in Ayurveda. **Nymphaeanouchali** is an important and well-known medicinal plant, widely used in the Traditional systems of medicines for the treatment of Prameha, Shophya, YakritVikara, Mutrakricha, Pradararoga, as a vajikarana drug, and as a rasayana. Due to its Tikta (Bitter taste) Rasa², it is useful in all rakta and pittaja disorders along with guna of agnivaradhana. Ayurveda classics described the use of Bitter taste herb for theregulation of heat, fever, and pitta conditions³. The bitter taste herbs are the most effective herbs for cooling pitta, sedating, detoxifying the liver, and reducing the deep-seated heat/fever in the interior of the body. Tikta Rasa also increases Agni (digestive fire) besides they do not aggravate pitta.

TAXONOMY⁴

Kingdom	:	Plantae
Order	:	Nymphaeales
Division	:	Spermatophyta
Family	:	Nymphaeaceae
Phylum	:	Tracheophyta
Genus	:	Nymphaea

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Class : Dicotyledons
Species : Nouchali

SYNONYMS^{5,6,7}

English : Blue Lotus, Blue Water Lily, Star Lotus
Hindi : Nilpadma, Neelkamal
Assamese : Seluk
Bengali : Shapla, Nilshapla
Gujarati : Kumud, Nilkamal
Kashmiri : Kumudapushpam
Punjabi : Nilofar
Sanskrit : Indivara
Tamil : Karu-netyal

Morphological Description^{3,8,9,10}

Herb occurs mostly in the broken form of varying sizes of dried pieces of flowers and buds which is dark brown.

Flower morphology is as:

Pediceal	0.5-1.0 cm long
Sepals	5 - 6 cm long, 1.5 - 2.0 cm wide. Oblong, lanceolate, tip acute or subacute, free, injoin to base of disc.
Petals	3.5 - 4.5 cm long, 2.0-2.5 cm wide; linear and oblong or lance head shaped, yellowish-brown
Stamen	Count vary from 6 to indefinite, free, enjoin to fleshy thalamus; filaments dilated at base
Anther	lingual appendages, introrse, ditheous
Gynoecium	Count vary from 3 to indefinite, surrounded by the thalamus
Style	Short
Ovary	Unilocular

Habitat^{11,12}

The dried flower of Nymphaeanouchali (Fam. Nymphaeaceae) known as Utpala; an aquatic herb, generally found in tanks and ponds throughout the warmer parts of India, particularly the Eastern Ghats. It is majorly grown in Southeast Asia as an ornate around the temples.

Name:

Nilotpala

English Name:

Water lily

Botanical Name:

Nymphaeanouchali

Ayurvedic Properties¹³

Rasa (Taste) : Sweet (Madhura), Astringent (Tikta)
Guna(Property) : Unctuous (Snigdha)
Veerya(Potency) : Cold (Sheeta)
Vipaka(End Result) : Sweet (Madhura)
Doshagnata (Effect) : Kaphapittashamaka

PHOTOCHEMISTRY¹⁴⁻¹⁸

Sterols, alkaloids, saponins, tannins, and flavonoids are present in solvent extracts of entire plants. Nymphayol (25,26-dinorcholest-5-en-3b-ol), a new sterol and lead compound are isolated from an extract of the flower by successive chloroform. Seeds contain protein, pentosan, mucilage, and tannins. The flower of the plant contains astragalgin, corilagin, gallic acid methyl ester, isokaempferide, quercetin-3-methyl ether, quercetin, kaempferol, 2,3,4,6-tetra-o-galloyl dextroglucose, and 3-o-methylquercetin-3'-o-beta dextroxylopyranoside. The quantitative

determination of gallic acid from hydroalcoholic dried flower extract has been observed in the HPTLC method. The proximate analysis showed the following:

1. Dry matter-8.4%
2. Crude protein-16.8
3. Ash-18.7
4. Crude fat-2.8
5. Crude fiber-26.3
6. Nitrogen free extract-35.4
7. Minerals
8. Sodium-1.19
9. Potassium-2.23
10. Calcium-0.52
11. Phosphorus-0.32
12. Calcium / phosphorus ratio- 1.63.

N. nouchali also showed polyphenols total-8.7%, free-5.9%, and bound-2.8%.

Pharmacological Actions

Antimicrobial Activities^{19,20}

Antimicrobial activity was tested using a disc diffusion assay. Bacterial susceptibility is tested by Mueller Hinton Agar and Fungal Susceptibility by Potato Dextrose Broth. The antibacterial activity of NHS extract varies depending on the various concentrations level used and the microorganisms which are tested. The inhibition zone varies between 8 mm and 25 mm in diameter. NHS extract has high susceptibility but in different concentrations to almost all kinds of microorganisms. The recent studies show even at a very low concentration of 62.5µg/ml the crude extract possessed significant inhibitory activity against *S.aureus*, *P.aeruginosa*, and *V.cholera*. The growth of *E. Faecalis* was inhibited at 125µg/ml of extract. The NHS extract at 500µg/ml concentration, effectively suppressed *P. aeruginosa*(20 mm) which was higher than the standard antibiotic streptomycin (17 mm) taken as reference. The notable anti-bacterial activity against *S.typhi*, *P.aeruginosa*, *E.coli*, and *V.cholerae* is shown by NHS extract. It also showed remarkable activity against *S.Aureus* and *B.cereus*. Thus it can be stated that both gram-negative and gram-positive bacteria can be effectively controlled by the NHS extract.

Antifungal Activity^{21,22}

Among all the tested fungi, the NHS extract showed a significant fungal growth inhibition as compared to the standard amphotericin B. NHS extract is tested against five fungi but the best result for fungal inhibition is obtained with *C.Albicans* showing 19 mm diameter.

Antihepatotoxic Activity^{23,24}

The Antihepatotoxic activity induced by the extract could be due to stabilization of cell membrane, hepatic cell regeneration, antioxidative enzyme activation such as glutathione reductase, glutathione peroxidase, superoxide dismutase, and catalase. It also significantly reduced the prolongation of sleeping time and prevented the CCl_4 -induced increase in liver volume and weight, and even mortality. Necrosis of the liver is also prevented by extract and promoted liver generation. On the administration of *Nymphaeastellata wild.*, flower varying dosage orally to rats for 10 days showed the hepatoprotection against carbon tetrachloride-induced elevation in serum marker enzymes, serum bilirubin, liver lipid peroxidation. This administration also shows the reduction in liver glutathione, liver glutathione peroxidase, glycogen, superoxide dismutase, and catalase activity.

Analgesic And Anti-Inflammatory Activity^{25,26}

The aconitine-induced writhing in mice showed the significant analgesic property in the extract. It also revealed antipyretic activity against carrageenin-induced rat paw edema. The result of anti-inflammatory activities was comparable to hydrocortisone.

Anti-Diabetic Effects^{27,28}

STZ-diabetic rats showed significant restoration of plasma insulin and glucose levels on oral administration of *Nymphayol* for 45 days which is near to normal levels. The increased level of insulin-positive β -cells is revealed in *Nymphayol*-treated diabetic pancreas which is immunocytochemically stained and Light Microscope. The insulin assay revealed that the action of *Nymphayol* which stimulates the secretion of insulin in β -cells may be due to the

reversal of the damaged endocrine tissue. The protection of pancreatic β -cells is enhanced due to the antioxidant defense mechanism of Nymphayol against the reactive oxygen species which are produced in hyperglycemic conditions.

Antiulcer Activity^{29,30}

Increases in the level of antioxidants, gastric mucus, and PGE₂ level and significant decreases in UI, lipid peroxidation, and MPO level are observed in the animals pretreated with (45 mg/kg) Nymphayol (NYM). Ethanol-induced ulcerated animals showed a decrease in the level of interleukin-10 (IL-10), an anti-inflammatory cytokine, and a significant increase in the Pro-inflammatory cytokines such as interleukin-6 (IL-6), interleukin-1 β (IL-1 β), tumor necrosis factor- α (TNF- α), and interferon- γ (IFN- γ), any inequalities found were amended by NYM pretreatment. As compared to the ethanol-induced ulcer group, NYM pretreatment increased the Bcl-2, an anti-apoptotic marker, and decreased the Pro-apoptotic markers including caspase-8, caspase-9, and caspase-3.

DNA - Protective Activities³¹

Scavenging capacity for numerous free radicals is present in the Nymphaeanouchali flower (NNF) extract. DNA damage is prevented by NNF extract and also no sign of toxicity was shown while quench cellular reactive oxygen species (ROS) generation induced by tert-Butyl hydroperoxide (t-BHP). The expression of both primary and phase II detoxifying enzymes is augmented by NNF extract which results in Oxidative stress combat. This is achieved by the mitogen-activated protein kinase (MAP kinase, p38 kinase and extracellular signal-regulated kinase (ERK)) phosphorylation which is followed by the nuclear translocation enhancement of the nuclear factor erythroid 2-related factor 2 (Nrf2). This reduced the cellular ROS generation and confers protection from cell death.

Traditional Uses

It can be used for medicinal use as a single or in combination with other drugs. Dried flowers of N. nouchali are also known as Utpala in Sanskrit are used as ingredients in several ayurvedic formulations having multiple uses. Polyherbal formulations also use it as an ingredient for anti-aging, rejuvenation, and menstrual irregularities. Roots and Rhizomes of N. nouchali have high nutritional value and can be eaten raw or roasted. Rhizomes of this plant are used in medicine, flower and flower stalks are used as vegetables, green manure, and animal fodder while flowers are used in the temples.

Therapeutic Uses

According to Plant Parts, its uses are :

Whole Plant :

It is used in Liver Disorders. Its roots, leaves, and flowers are found useful in the treatment of Infertility, Diabetes, Heart Diseases, Dysentery, Indigestion. It acts as Diuretic, stimulant, Cardiotonic, and Aphrodisiac.

Flower :

3gm of drug is used in Pipasa Daha (Burning Thirst), Raktapitta (Bile-Blood), Chardi (Vomiting), Murchha (Fainting), Hradroga (Heart Disease), Mutra Krachha (Painful Micturition), Jvaratisar (Diarrhoea with fever), Diabetes Mellitus (Madhumeha).

Palpitation of the Heart can be treated by a decoction of flower and also used as a narcotic, the syrup is used in case of high fever, apoplexy, inflammatory disease. The Filaments have astringent and cooling effects in the burning sensation of the body, Bleeding Piles and Menorrhagia.

Rootstock:

Powder is used to treat dyspepsia, Diarrhoea, and Piles.

Root:

The roots are used in Bleorrhagia, UTI, Infertility, Diabetes.

Rhizome and Stem:

Used in the treatment of Bleorrhagia, Menstrual Problem, and UTI.

Flower and Rhizome:

They are astringent, antiseptic, mild sedative, used in infusion in chronic diarrhoea, and as douche in leucorrhoea and vaginitis, as a gargle for sore throat.

Leaf:

Leaves are crushed and applied as a lotion in eruptive fever.

Seed:

Seeds are used in Diabetes Mellitus.

Petiole:

Petiole is taken and crushed to make a paste, common salt, seed powder (*Cuminumcyminum*), butter, and few drops of honey are added and given in excessive menstrual discharge. It is also used in bleeding during Pregnancy.

Conclusion:-

N. nouchali is the traditional herb with multiple uses in Indian traditional rituals as well as medicinal uses as antioxidant, hepatoprotective, anti-diabetic, anti-inflammatory, analgesic, act as DNA protective agent. It is very effective in Bleeding Disorders. It is highly recommended for gynecological disorders like menorrhagia, metrorrhagia, and many other menstrual problems.

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