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Review Article

Scientific Review on Kumud – *Nymphaea alba* linn.

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ABSTRACT

Background: Nymphaea alba commonly known as white water lily, an aquatic flowering plant. It contains the active alkaloids nupharine and nymphaeine, and flowers possess sedative and acts as an aphrodisiac. Roots and stalks are used in traditional herbal medicine along with the flower, the petals and other flower parts are the most widely used for medicinal purpose. In modern herbal practice it is used as a remedy for dysentery. The aim of the article is to update the pharmacological actions of the plant for the basis of future research. Kumud is described in Charaka Samhita, Susruta Samhita, Astanga Sangraha and Astanga Hridaya, Nigahntu, Pushpayurveda etc. Objective: Our present study was undertaken to give review on kumud with the help of classical references. Material & method: Regarding the plant reviewed from various research article, review article, various nighantu, samhita & API. Result: This review article helpful for all the Ph.d researcher because all the references are used in this review article from API, Text books of Darvya guna & pharmacognosy and some of previous review & research article. Conclusion: The current review focused on ethanobotanical, photochemistry, and pharmacological study on kumud flower. The detailed review of Kumud (Nymphaea alba) was compiled from ancient as well as recent study Kumud so it was concluded that the (Nymphaea alba) had many properties and it's very useful in many diseases as it reviewed in detailed in many researches. Kumud used in different disorders anti-depressant, antidiabetic, antioxidant, analgesic, anxiolytic, antifertility, contraceptive, uv blockade activity. Although different research has been done on Nymphaea alba, still there is huge scope to explore its hidden potentials. Nymphaea alba extrat also found to have a certain degree of anti- cancer and anti- bacterial activity etc.

INTRODUCTION

Nymphaea alba belongs to Nymphaeaceae a prominent plant in traditional Indian medicine has been long used to treat gastrointestinal, genital, and bronchial conditions. It is a rich source of flavonoids, phenols, and fatty acids. Studies show that flowers, leaves, and rhizome of N. alba have various medicinal properties. It includes anti-

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inflammatory, analgesic, astringent, anticancer, and antioxidant property [1,2,3,4,5,6,7] Nymphaea alba which comprises of the several valuable medicinal plants with a wide range of pharmacological and biological actions along with established to have important phytochemical components [8]. The genus Nymphaea comprises of about fifty fifty species [9], out of which five species are present in India, and some are grown as ornamental plant [10]. Nymphaea alba frequently referred to as "European White Water Lily or Nenuphar. It is a perennial hydrophyte having a black, Sturdy, almost horizontal, scarcely branched rhizome submerged in the mud [11]. It preferably grows in neutral to alkaline waters in puddle, stagnant or slightly moving lakes and marshy areas [12]. It grows at depth of about 5 – 3m, in water over mud, silt or Peat [13]. It is spread extensively throughout Europe, North Africa, north & central Asia, southwest Asia, Finland, India, China, Russia, Turkey and Poland. Nymphaea alba was thought to be a plant of lowland waters but is also occurs at higher altitudes in Kashmir (India) at 1500 m., in Angle Tarn (England) at 456 m., in Isla (Scotland) at 426 m. and in Ireland at 335m.It occurs in temperate and tropical regions. In India it is widely distributed in the lakes and ponds of Bengal, Orissa to Kashmir. All the parts of the plant have medicinal uses in traditional system of medicine.[14] It is used as an aphrodisiac, anodyne, antiscrophulatic, astringent, cardio tonic, and demulcent, antioxidant, sedative and anti-inflammatory. It also produces calming and sedative effects upon the nervous system, and is useful in the treatment of insomnia, anxiety and similar disorders. Its anti-carcinogenic action and inhibition of renal oxidative stress and hyper proliferative response were reported. Externally it can be used to make a douche to treat vaginal soreness or discharges. [15] A decoction of the root is used in management of diarrhoea caused by irritable bowel syndrome. It is used to treat bronchial catarrh & kidney pain. It is taken as gargle for sore throat. Studies reported the decoction is used in uterine cancer. It is also used in treatment of diaphoresis [16] in combination with slippery elm (Ulmus rubra) or flax (Linum usitatissimum) it is used as a poultice to treat boils and abscesses. [17]

MATERIAL AND METHODS

References are searched from various authoritative texts and worldwide accepted scientific databases concerning the taxonomy, morphological description and pharmacological action of Kumud.

SYNONYMS [18]

English : European White Water Lily
Latin : Nenuphar
Arabic : Nilufar
Bengali : Kumuda, Shandh shaluka
Gujrati : Piyanu
Hindi : Kanval, Kokka

Species [19]

Nymphaea alba linn. – Sveta Kauvalaya (White flower)

Nymphaea rubra Roxb. – Raktopala (Big flower red in colour)

Nymphaea pubescens willd. – Raktopala (Small flower red in colour)

Nymphaea stellate willd. – Nilotpala (Blue flower)

Charka mentioned Utpala & Kumuda separately which are blue & white verities A/c to P.V. Sharmaji.

Classical categorization [2]

Charka	Mutra, Viryajaniya
Susruta	Utpaladi gana
Vagabhata	Mutra, Viryajaniya

Properties [21]

Rasa	Madhura, Kasaya, Tikta
Guna	Laghu, Snigdha, Picchila
Virya	Sita
Vipaka	Madhura
Karma	Tridoshara, Medhya,

Part Used: Rhizome, Flower, Seeds, Whole plant.
Formulation: Utpaladi Churna, Utpaladi hima, Nilotpaladi hima, Sarbat niluphar.

CULTIVATION

Water lilies are not only decorative, but also provide useful shade which helps reduce the growth of algae in ponds and lakes.[22] Many of the water lilies familiar in water gardening are hybrids and cultivars. These cultivars have gained the Royal Horticultural Society's Award of Garden Merit.

Taxonomy

Kingdom	:	Plantae
Division	:	Angiosperms
Order	:	Nymphaeales
Family	:	Nymphaeaceae
Genus	:	Nymphaea
Species	:	Nymphaea alba

MORPHOLOGY

- Flower: The flowers of this plant are regular, bowl shaped, and anthers are yellow in colour
- Leaves: The length of leaves is 10-25 cm, oval shaped and colour of this plant ranges from dark green above and reddish brown below.
- Fruit: The fruit of the plant is of fleshy berry and capsule in nature.
- Habitat: The plant is commonly found in ponds, lakes, and rivers.
- Flowering time: The flowering time is from June to August.[23]

ETHNOBOTANICAL USES

Nymphaea alba has a history of ethno botanical applications in different cultures [24]. Almost each part of this plant has been used to treat variety of illness [25]. Its root and rhizome were used to treat or relief GIT, reproductive and lungs disorder [26]. Ariel parts specially leaves as well as roots of Nymphaea alba were utilized as poultice to boils, inflamed skin and scrofulous ulcers. The pulp of its rhizome shows rubefacient effect when applied externally [27]. Seeds of Nymphaea alba used for its Diaphoretic action [28]. A decoction prepared from its root was used in irritable bowel syndrome for management of diarrhoea. It was also utilized for the treatment of bronchial catarrh & kidney pain and for sore throat [29]. Moreover, this plant has been used from older times for various actions including aphrodisiac, anti-inflammatory action, anodyne, astringent, cardio tonic, demulcent, antioxidant, and sedative action [30]. Apart from traditional usage of Nymphaea alba for its medicinal credence, it is also consumed as a food supplement for its nutritional importance like its soft part of leaves, stalks bearing flowers are part of diet of several ethnic groups. In addition its Starch rich rhizomes are consumed in raw form or boiled at several places. A combination of black pepper and its pistils are used for internal and external purposes. Flour of its seeds is mixed with wheat and barley flour [31]. During dearth, its rhizomes were boiled and parched seeds were consumed as meal in China and East Indies its dried seed flour with wheat flour was used in making mixed breads. In addition its rhizomes are used for tanning purposes. [32]

PHYTOCHEMICAL STUDIES

It refers to the study of different phytochemicals, which are the various chemicals derived from medicinal plants. We have discussed the various phytochemicals present in N. alba in this section Nymphaea alba is reported to have variety of chemical constituents including alkaloids, tannins, flavonoids, Phenolic content and glycosides [33,34]. Its flowers were established to have isolated aglycons including: quercetin, isokaempferide, kaempferol, and apigenin along with various glycosides moieties including quercetion 4'-β-xyloside, 3-methylquercetin 3'-β-xyloside as well as combination of quercetin 3-galactoside and 3-glucoside [35]. The flowers of N. alba have flavonoids. The flowers and rhizome of N.alba were found to be rich in phenols such as ellagic and gallic acid. It also contains essential

fatty acids that have alimental value. It was identified a rich source of β-sitosterol and a high antioxidant property [36]. It was also obtained to have variety of phenolic acids like Gallic Acid, Ellagic acid, methyl and ethyl esters of gallic acid, also found to have traces of Ferulic, vanillic, p-cumaric and p-hydroxy benzoic acid [37]. Its alcoholic extract of flowers was reported to have cardiac glycoside Nymphalin. It was estimated from chemical composition of Nymphaea alba that it has abundance of proteins, essential inorganic compounds which provides energy and has less fiber [38]. In another research, presence of polyphenols and flavonoids is confirmed, a total of 27 compounds were identified, having major proportion of rutin and pcoumaric acid along with caffeic acid, catechin, epicatechin, naringin, naringenin, vanillic acid, corilagin, tannic acid, gallic acid, ferulic acid, ellagic acid, quinic acid, kaempferol, castalin, orientin, apigenin, luteolin, brevifolin, ellagic acid rhamnosyl, quercetin, HHDP-hexoside [39]. It is has traces of some inorganic substances including copper, sulphate, chloride [40]. Nymphaea alba rhizomes were also proved to have five main phenolics including, gallic acid and its methyl and ethyl ester, ellagic acid and pentagalloyl glucose [41].

PHARMACOLOGICAL ASPECTS

Antioxidant activity

Free radicals or reactive oxygen species have deleterious effects on human body, foodstuffs and fats, which developed an urge to find antioxidant substances from natural sources, which either delay or inhibit oxidation. Nymphaea alba rhizome ethanolic extract shows significant antioxidant activity due to presence of tannins and phenolic compounds. IC50 values for DPPH, NO and superoxide radical-scavenging activity were 63.9, 49.21 and 79.56 µg/ml, respectively. The IC50 of extract is more comparable to the standard drug for scavenging superoxide anion than the other methods. The antioxidant activities of N.alba ethanolic extract was moderate in comparison to the standard antioxidant ascorbic acid, achieved by the scavenging ability observed against DPPH, NO radicals and superoxide anions[42] Nymphaea alba flower aqueous and ethanolic extract were tested for its antioxidant abilty by performing DPPH radical scavenging assay, Hydroxyl radical scavenging assay and nitric oxide scavenging assay. All the assay concluded the ethanolic extract of N. Alba showed significant antioxidant activity when compared to the aqueous extract tested. [43]

Anxiolytic activity

Ethanolic extract of Nymphaea alba extract was assessed in mice model for its motor activity by performing foot shock induced aggression test (FSIAT) and rota rod test (RRT). In the study Diazepam 1 mg/kg served as a standard anxiolytic drug, administered orally. The result obtained in the study proves the anxiolytic activity and muscle relaxant property of N. alba. [44]

Urolithiac activity

In a study, urolithiasis was induced by inserting zinc disc in the urinary bladder which was followed by supplementing 1% ethylene glycol in drinking water. The reduction in weight of the stones was used as criteria for assessing the preventive or curative regimen, ethanolic extract of dried leaves of Nymphaea alba Linn was administered orally in wistar albino rats. This was evaluated for its antiurolithiatic potential, the study reported that the oral administration of the Nymphaea alba Linn has resulted in significant reduction in the weight of bladder stones compared to the control group used.[45]

Central depressant activity

The ethanolic extract of the rhizome is used for studying the central depressant activity of Nymphaea alba.[6] The behavioral effect of the extract (75, 150 and 300 mg/kg) was evaluated in mice using diazepam induced sleep test, holeboard

test, beam walking assay, staircase test, open field test and elevated plus maze assay.

Diazepam-induced sleep-in mice

By potentiating the diazepam induced sleep, the ethanol extract of N. alba seems to possess sleep inducing properties.

Hole-board test

The ethanol extract significantly reduced the number of head dips comparable to that of the standard agent (Diazepam)

Beam walking assay

The ethanol extract did not significantly increase the number of foot slips. However, diazepam significantly ($P < 0.05$) increased the number of foot slips.

Staircase test

The ethanol extract significantly reduced both the number of upward steps climbed as well as number of rearings. Diazepam, the standard agent significantly ($P<0.05$) reduced the number of readings but increased ($P<0.001$) the number of upward stairs climbed.

Plus maze test

The elevated plus maze is a commonly used test in the search of anxiolytic agents to study the behaviour of the animal in this study the rodent typically avoids the open arms of the maze due to fear or anxiety induced by the open space. The study concluded that N. alba rhizome ethanol extract shows significant sedative property due to presence of bioactive constituents present in it.

Analgesic activity

Nymphaea alba rhizome ethanolic extract was investigated for its analgesic activity by acetic acid- and formalin-induced analgesia. The extract at a dose of 600 mg/kg was found more potent in acetic acid induced pain and showed more licking activity in both the phases of formalin acid induced pain than the standard drug.[47]

Antifertility and contraceptive activity

Nymphaea alba is used orally with other ingredients as a contraceptive and antifertility for both male and female.[48] In a study, Patients of anovulatory infertility with menstrual irregularities and polycystic ovarian disease in the age group of 20-40 years were randomly allocated to test (n=20) and control (n=10) groups. Unani formulation consisting of Withania somnifera, Anogeissus latifolia, Nymphaea alba and Barleria prionitis was administered in powdered form 12 gm (in two divided doses) daily from 5th day of menstrual cycle for 5 days along with milk for three consecutive cycles. In control group clomiphene citrate in 50 mg dose was administered once daily for the same duration. Primary outcome measure was ovulation. Secondary outcome measure was conception rate. Results were analysed using Student't' test, Chi-square ($\chi 2$) and Fisher Exact test. Ovulatory rate was found to be 40%, 35.3% and 68.8% in 1st, 2nd and 3rd cycle in test group, while in control group it was 60% in 1st cycle and 55.6% in each 2nd and 3rd cycle, respectively. Conception rate was 10% and 18.8% in 1st and 3rd cycle in test group, while in control group it was only 10% in 1st cycle during treatment. The study concluded that the effect of unani formulation can be used as an alternate therapy for ovulation induction.[49]

Anti-solar activity

In this study, seven medicinal, plants: Achillea withelmsii L., Calendlda officinalis L., Ruta gravelens L., Fumuria parviflora Lam, Lawsonia inermis L., Nymphaea alba L. and Punica granutum which contains high amounts of flavonoids. Because of flavonoids contents, this plants may have some active of against sun rays. Therefore, the aim of this study is the evaluation of sun protection activity of these plant extracts by semid dilution method. For this aim total extraction, ethyl acetate extract was obtained and their UV spectrum and SPF value were determined. [50]

Anticarcinogenic activity

The study based on Anti carcinogenic effect of Nymphaea alba against oxidative damage, hyper proliferative response and renal carcinogenesis in Wistar rats. The results showed that Nymphaea alba as a potent chemopreventive agent. [51]

Bio indicator of metals

Study was conducted to determine chemical characteristics of Nymphaea alba, Nuphar lutea, water, and sediments from fourteen lakes of Pojezierze Leszczy*f*skie (West Poland) with different levels of some nutrients and heavy metals. The bioindicative value of both examined species were also studied. Nymphaea alba and Nuphar lutea increases their role as bioindicators because of necessity of conservation of their habitats and limits possibility of their use in common monitoring. Study concluded positive correlations between concentrations of Ba, Co, Mn, and Cu in Nymphaea alba as well as Sr in Nuphar lutea and these elements in their environment suggest that the examined nymphaeids may be useful as the indicator of those metals.[52]

DISCUSSION

Nymphaea alba is a well-known medicinal plant used in the Ayurveda and Siddha systems of medicine to treat Madhumeha (diabetes), shopha (inflammation), yakritgata vikara (liver illnesses), Mutrakriccha (urinary disorders), pradara (menorrhagia), blenorrhagia, menstruation problems, and act as an vajikarana (aphrodisiac). It is well known medicinal herbs with multidimensional effects such as hepatoprotective, anti-inflammatory, CNS depressant, antibacterial, anticarcenogenic effect, Hepatoprotective, Cardio tonic, also usef ul in the treatment of insomnia & especially antidiabetic action proved by many researches. Nymphayol, a steroid extracted from the flowers, has been scientifically proven to be responsible for the traditionally stated antidiabetic effect; it restores damaged endocrine tissue and increases insulin secretion in - cells. However, when compared to the extent of its traditional applications, the number of research undertaken is still insignificant.

CONCLUSION

Nymphaea alba has been used as an therapeutic agent for a variety of diseases, as illustrated in this article. In many research works has been proven its uses beyond ethano pharmacological aspects in experimental model both in vitro & in vivo. Alkaloids and glycosides resins & tannins which were isolated from this plant may be responsible for its pharmacological activities. Various part of the plant exhibits anti-depressant, antidiabetic anti-bacterial, anti- cancer, anti- oxidant, and analgesic, anxiolytic, antifertility, contraceptive, uv blockade activity.Although different research has been done on Nymphaea alba, still there is huge scope to explore its hidden potentials.

Natural Source of *Kumud (Nymphaea alba)*

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