Review Article

Int J. Pharm. Drug. Anal, Vol: 12, Issue: 3, 2024; 25-33

International Journal of Pharmaceutics and Drug Analysis

Content Available at www.ijpda.org ISSN: 2348:8948

A COMPREHENSIVE REVIEW ON NILOFAR (NYMPHAEA ALBA LINN): UNANI PERSPECTIVES AND THERAPEUTIC POTENTIALS

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Received: 24 May 2024 Revised: 11 July 2024 Accepted: 01 August 2024

Abstract

Nilofar (Nymphaea alba Linn) is commonly known as the white-water lily. It is a hydrophyte with enormous medicinal properties, renowned for its alluring white flowers. It is distributed worldwide in ponds, lakes, and marshy areas. Its various parts have been extensively utilized in Unani medicine globally, particularly in the Indian subcontinent, to prevent and treat a variety of ailments. Numerous research findings have documented its therapeutic effects, including anti-inflammatory, anti-hepatitis C, anti-diarrheal, hepatoprotective, antibacterial, anticarcinogenic, antiurolithiatic, uterotonic, anxiolytic, antidepressant, CNS depressant, anticonvulsant, antihyperlipidemic, and antioxidant activities. In Unani medicine, Nilofar is used to treat various illnesses such as palpitations, diarrhea, hepatotoxicity, inflammation, migraines, anxiety, depression, and convulsions. Nilofar contains a variety of chemical constituents, including alkaloids, tannins, flavonoids, phenolic content, glycosides, aglycons, phenolic acids, cardiac glycoside nymphalin, and others. This review explores the therapeutic potential of Nilofar, shedding light on its pharmacological properties, traditional uses, and emerging research. By combining traditional knowledge with the latest scientific findings, this review aims to encourage further research and facilitate its integration into mainstream healthcare practices.

Keywords: Nilofar, Nymphaea alba, Unani System of Medicine, Antioxidant, Anticarcinogenic.

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DOI: https://doi.org/10.47957/ijpda.v12i3.599

Produced and Published by

South Asian Academic Publications

Introduction

Nilofar (Nymphaea alba Linn) belongs to the Nymphaeaceae family, which includes many valuable medicinal plants known for their various pharmacological and biological effects [1]. The genus Nymphaea comprises around forty to fifty species [2], with five species found in India, some of which are grown for ornamental purposes [3]. Nymphaea alba, commonly known as the European White-Water Lily or Nenuphar, is a perennial hydrophyte. It has a sturdy, almost horizontal rhizome that is black and submerged in mud [4]. This plant prefers neutral to alkaline waters and typically grows in ponds, stagnant or slowly moving lakes, and marshy areas. It thrives at depths of 0.5 to 3 meters, often in water over mud, silt, or peat [5]. *Nilofar is* widely distributed across Europe, North Africa, North and Central Asia, Southwest Asia, Finland, India, China, Russia, Turkey, and Poland [4,6,7,8]. Although originally thought to prefer lowland waters, it also grows at higher altitudes, such as in Kashmir (India)

at 1500 meters, Angle Tarn (England) at 456 meters, Isla (Scotland) at 426 meters, and in Ireland at 335 meters [4,9]. This species can be found in temperate and tropical regions [10]. It is commonly found in lakes and ponds from Bengal and Orissa to Kashmir in India [3,11]. Modern pharmacological studies have confirmed that *Nilofar*, based on its traditional uses, effectively treats various diseases. Through detailed research, researchers have identified the pharmacological effects of different extracts or specific compounds from Nymphaea alba. Both in laboratory tests (in vitro) and animal studies (in vivo), it has been shown that Nymphaea alba has potential therapeutic properties for treating conditions like diarrhea [2], liver damage (hepatotoxicity) [12,13], inflammation [1,14,15], anxiety [15], depression [16], and seizures [17]. Moreover, extracts from Nymphaea alba have also demonstrated some level of effectiveness against cancer [3] and bacteria [18]. This review discusses how *Nilofar* and its active components help manage and prevent various diseases by affecting different biological pathways.

Habitat distribution and botanical description

Nilofar is found in many parts of the world, including Europe, North Africa, Southwest Asia, India, China, and Russia [4,6,7,8]. In India, it lives in the lakes of Kashmir at heights below 1800 meters [3, 11]. People also keep it in ponds and lakes for decoration [3].

Nilofar varies in size and can spread up to 20 feet. Its flowers are large and white, with 4 to 5 sepals and 12 to 33 petals arranged in 2 to 3 or more rows [19]. The sepals are linear or oval and have a net-like pattern. The outer petals are shaped like the sepals [19]. The plant has many yellow anthers in the center [20]. The flowers close at night and open during the day [21]. The leaves are oval or heart-shaped, up to 30 centimeters in diameter, and can cover 150 centimeters of area per plant [19,22]. The top of the leaves is dark green, while the underside is reddish-brown [23]. The plant has a smooth, slightly striped outer layer [24]. Its fruits are fleshy, spongy, and contain up to 1700 seeds, which are 2-5 mm long, dark olive green, and buried in pulp [4,19]. Nymphaea alba has perennial rhizomes, which help it survive and regrow [25].

Table 1: Taxonomic position of *Nilofar* (Nymphaea alba Linn)

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermtophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Magnoliidae
Order	Nymphaeales
Family	Nymphaeaceae
Genus	Nymphaea
Species	alba

Table 2: Vernacular names of *Nilofar* (Nymphaea alba Linn)

Arabic	Habul Aroos, Kirnabulma
Farsi/ Urdu	Nilofer
Unani	Nameeqa, Neemmqa
Suryani	Kirnaba, maya, ma
Ayurveda	Kumuda, Utpala
English	European White-Water lily
Hindi	Neelophal, Kanwal
Bengali	Swet Padma, Kamal
Kashmir	Brimposh
Tamil	Tamarai
Malayalam	Tamara, Aravindam
Kannada	Kamala
Telugu	Tamara

Ethnobotanical uses of *Nilofar* (Nymphaea alba Linn)

Nilofar has a history of being used in traditional medicine by different cultures [10]. Almost every part of this plant has been used to treat various illnesses [26]. The root and rhizome were used for stomach, reproductive, and lung problems [26]. The leaves and roots were used as a poultice for boils, inflamed skin, and scrofulous ulcers. The pulp of the rhizome has a warming effect when applied to the skin [27]. The seeds are used to promote sweating [28]. A decoction made from the root was used to manage diarrhea and treat bronchial catarrh, kidney pain, and sore throat [6]. Nymphaea alba has been known for its aphrodisiac, anti-inflammatory, pain-relieving, astringent, heart-tonic, soothing, antioxidant, and sedative properties [25]. Besides its medicinal uses, it is also eaten as a food. The soft parts of the leaves and flower stalks are part of the diet of several ethnic groups. The starch-rich rhizomes are eaten raw or boiled. A mix of black pepper and its pistils is used for both internal and external purposes. The seeds are ground into flour and mixed with wheat and barley flour [29]. During times of scarcity, its rhizomes were boiled and its seeds were eaten in China and the East Indies. Its dried seed flour was also used to make mixed breads. Additionally, its rhizomes are used for tanning purposes [30].

Active Chemical Compound of *Nilofar*(Nymphaea alba Linn)

Nilofar (Nymphaea alba Linn) contains many chemical compounds, including alkaloids, tannins, flavonoids, phenolic content, and glycosides [31, 32, 33]. The flowers have compounds like quercetin, isokaempferide, kaempferol, and apigenin, as well as glycosides such as quercetin 4'-β-xyloside and 3-methyl quercetin 3'-β-xyloside as well as a combination of quercetin 3-galactoside and 3-glucoside [32]. They also have phenolic acids like gallic acid, ellagic acid, and their esters, along with small amounts of ferulic, vanillic, p-coumaric, and p-hydroxybenzoic acids [32, 33]. The flowers' alcoholic extract contains the cardiac glycoside nymphalin [29]. Nymphaea alba is rich in proteins and essential inorganic compounds but low in fiber [34]. Research has confirmed

the presence of polyphenols and flavonoids, identifying 27 compounds, including rutin, p-coumaric acid, 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, and HHDP-hexoside [35]. There are also traces of inorganic substances like copper, sulfate, and chloride [19]. The rhizomes have five main phenolics: gallic acid and its methyl and ethyl esters, ellagic acid, and pentagalloyl glucose [36].

Unani description and key formulations of *Nilofar* (Nymphaea alba Linn)

According to the Unani physicians, *Nilofar* (Nymphaea alba) has a cold and moist temperament (*Mizāj*), with varying degrees of coldness and moistness i.e. Cold 2º Moist 2º and Cold 3º Moist 3º [37,38]. The aerial parts of the plant, its Flowers, Seeds and its Rhizome are used in *Unani Medicine* in the form of drugs to treat various ailments [39]. The dosage prescribed by physicians varies depending upon its part usage: for flower (*Gul*)5-7 adad, in powder (*safoof* form) 3-10 masa and as decoction (*Joshanda*) 2 tola 7 masa, root (*Beekh*)1-3 masa[38,40] and seed (*Tukhm*) 10 masa [38]. It is highly toxic for *Masana* (Urinary Bladder) [38, 39]. Correctives (*Muslih*) are advised to counter the adverse effect is *Shahed* (Honey). Several Substitutes (*Badal*) for *Nilofar* are *Khatmi* (Althaea officinalis Linn) and *Banafsha* (Viola odorata Linn) 38, 39]. The Classical Unani text throws light on *Nilofar*'s several pharmacological actions, which includes Muqawwi *Bah* (Aphrodisiac), *Musaffi dam*(Blood purifier), *Dafe humma*(Antipyretic), *Habisuddam* (Haemostyptic), *Munavvim*(Hypnotic), *Musakkinasab* (Nervine tonic), *Muqawwiqalb*(Cardio tonic), *Muqawwidimagh*(Brain tonic), *Muqawwirehm* (Uterine tonic) and *Qabiz*(Astringent) [37,38,39,40,41].

Nilofar has long been utilized by Unani experts to cure various illnesses, including *Sahar*(Insomnia) [38,39,40,41,42,43], *Malencholia*, *Humma*(Fever), *Warme kabid*(Hepatitis), *Khafqan*(Palpitation) [38,39,40,41,44], *Shaqeeqa*(Migraine), *Kasrateatash*(Polydipsia), *Ishaal muzmin*(Chronic diarrhea), *Sue hazm*(Dyspepsia), *Bawaseer*(Piles), *Warme masana*(Cystitis), *Warme gurda*(Nephritis), *Warme ama*(Enteritis), *Ziyabetus*(Diabetes), *Amraze ain*(Eye disorder), *Balghami aur damvibukhar*(Bilious and haemolytic fevers), *Sozishhalak*(Sore throat) and Vaginitis [37,38,39,40,41].

In the *Unani System of Medicine*, many treatments are made from mixtures of different ingredients. These premade formulations are used to treat various illnesses. The dosage forms vary depending on the need, pharmacy principles, and treatment plan. The Indian government has recognized several pharmacopeias and formularies to produce and provide these medications in different forms. Here are some key formulations that include *Nilofar* (Nymphaea alba) as an ingredient *Sharbat Nilofer*, *Majoon suparipaak*, *Arq murakkab musaffi khoon*, *Sharbat ahmad shahi*, *Dayakuza*, *Safoof lodh, Sharbat ajaz*, *Sharbat denar*, *Sharbat shifa*, *Sharbat gaozaban*, *Arq fawakah*, *Arq harabhara* [37,38,39,41], *Kushta moti* and *Kushta aqeeq*,[40] etc.

Figure 1: Medicinal parts of *Nilofar* (Nymphaea alba Linn) used in the Unani system of medicine

Therapeutic implications of *Nilofar* (Nymphaea alba Linn) and its differentingredients in treating health conditions

Anti-Inflammatory Activity

The ethanol extract of Nymphaea alba flowers was tested using two models: acetic acid-induced vascular permeability for acute inflammation and cotton-pellet-induced granuloma for chronic inflammation. Mice were given 100mg/kg and 200mg/kg doses of the extract. In the chronic model, these doses showed 10.1% and 41.5% inhibition of granuloma formation, compared to 57.30% for the standard drug diclofenac. In the acute model, the extract showed 20.35% and 33.54% inhibition, while diclofenac showed 43.13% [14].

The ethanol extract of Nymphaea alba rhizome was tested for pain-relieving effects. Male mice (20-30g) were used in experiments with acetic acid-induced writhing and formalin-induced pain. The extract was given in doses of 200mg/kg, 400mg/kg, and 600mg/kg, along with a standard dose of 100mg/kg paracetamol. The extract showed inhibition rates of 57.55%, 64.52%, and 76.55%, respectively, compared to 51.18% for paracetamol. The 600mg/kg dose showed better results than the standard drug in formalin-induced pain [14].

Researchers studied the anti-inflammatory effects of Nymphaea alba flowers using an ethanol extract. They tested the extract on mice for both short-term (acute) and long-term (chronic) inflammation. For acute inflammation, they used a model where acetic acid increased blood vessel permeability. For chronic inflammation, they used a model where cotton pellets caused tissue growth

(granuloma). They gave the mice either 100mg/kg or 200mg/kg doses of the ethanol extract. The 100mg/kg dose reduced granuloma formation by 10.1%, and the 200mg/kg dose reduced it by 41.5%. For comparison, the standard anti-inflammatory drug diclofenac reduced granuloma formation by 57.3%. In the acetic acid model, the 100mg/kg and 200mg/kg doses of the extract reduced blood vessel permeability by 20.35% and 33.54%, respectively. Diclofenac sodium reduced it by 43.13% [15].
Another study used the hydroalcohol extract of Nymphaea alba flowers to test membrane stabilization. Concentrations of 200 µg/ml and 500 µg/ml were used, showing significant stabilization of the HRBC membrane. The 500 µg/ml concentration provided higher protection [1].

Anti-hepatitis C activity

A study tested the anti-hepatitis C activity of methanol and acetone extracts of Nymphaea alba, along with its purified fractions. The research used a transfection model on the Huh-7 cell line and the MDBK cell line to analyze the synergistic effects of the purified fractions combined with interferon. Using an in-vitro transfection model, the effects of two isolated acetone extract fractions, 'N1' and 'N8,' on hepatitis C virus replication were observed by studying viral gene expression. The study also examined the interaction of NS3 protease, a key viral enzyme, with fourteen constituents of Nymphaea alba using Molecular Operating Environment (MOE) software. Boceprevir, a known NS3 protease inhibitor, was used as a standard. The results showed an 84% and 94% decrease in hepatitis C virus NS3 gene expression. Additionally, the combination of boceprevir with the isolated fractions had synergistic effects, further increasing the inhibitory effect on hepatitis C virus replication [45].

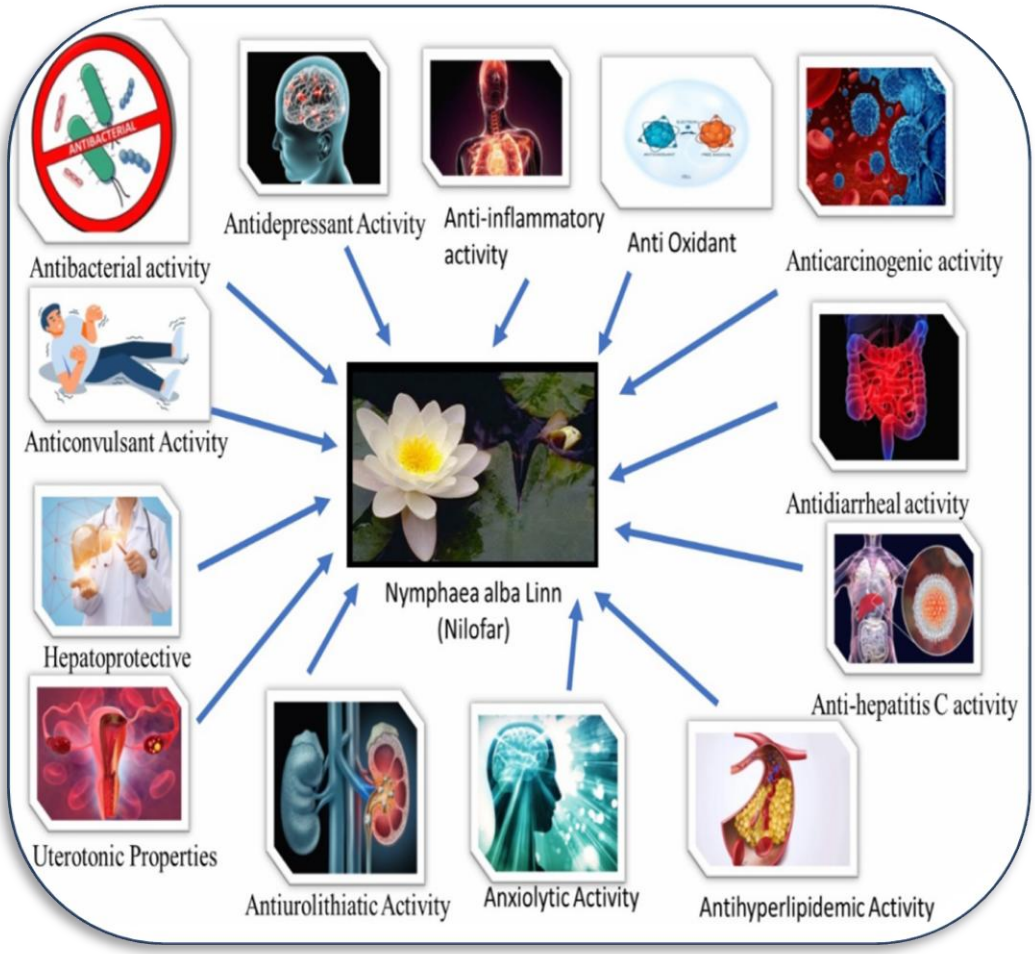

Figure 2: Pharmacological activities of *Nilofar* (Nymphaea alba Linn) in disease prevention and management by modulating various biological activities.

Anti-Diarrheal Activity

The anti-diarrheal properties of Nymphaea alba were tested using a castor oil-induced diarrhea model in Wistar rats. An ethanol extract was prepared from the rhizomes and roots of the plant. The rats were given 100 mg/kg and 200 mg/kg doses of the extract orally. These doses significantly reduced the rate of defecation. As a comparison, a standard dose of 5 mg/kg diphenoxylate was used. The ethanol extract at 100 mg/kg and 200 mg/kg showed comparable inhibition rates of 92.6% and 93.8%, respectively [2].

Hepatoprotective Activity

Nymphaea alba flowers were tested for liver-protective effects using methods that induce liver damage with CCl4 and acetaminophen. Two doses of ethanol flower extract (200mg/kg and 400mg/kg) significantly reduced wet liver

mass and liver quantities. The biochemical results showed a significant decrease in SGOT, SGPT, ALP, bilirubin, and cholesterol levels compared to the control group. The 400mg/kg dose showed the highest level of inhibition in both models [12].

In another study, the extract from Nymphaea alba leaves was tested for liver-protective effects using a carbon tetrachloride-induced liver damage model in eight-week-old male Wistar albino rats. Silymarin was used as the standard drug. Two doses of aqueous ethanolic extract (100mg/kg and 200mg/kg) significantly improved liver function, oxidative stress parameters, and TNF-α levels. The results confirmed that the aqueous ethanolic extract of Nymphaea alba has hepatoprotective activity comparable to the standard drug silymarin [13].

Hepatoprotective Activity Against Isoniazid-Induced Hepatotoxicity

In this study, liver damage was caused in rats by giving them isoniazid (50mg/kg). Silymarin (50mg/kg) was used as the standard drug. Nymphaea alba flower ethanol extract was given in doses of 200mg/kg and 400mg/kg along with Silymarin for 31 days. Isoniazid was given from the 4th to the 31st day of the study in both standard and test groups. All drugs were given orally.Both doses of the Nymphaea alba extract significantly reduced the increase of liver marker enzymes (SGOT, SGPT), serum bilirubin, catalase, malondialdehyde (MDA), and glutathione (GSH) in the rats. This shows that the extract has a protective effect against liver damage caused by isoniazid. It also prevented the increase in liver MDA content and boosted GSH content, protecting the liver from damage caused by isoniazid [46].

Antibacterial Activity

Researchers tested the antibacterial properties of Nymphaea alba using extracts made with ethanol and acetone from the whole plant. They tested these extracts against three bacteria strains: E. coli, Vibrio sp., and S. aureus. The acetone extract showed a larger inhibition zone (26.2 mm) against Vibrio sp. compared to the ethanol extract (18.8 mm). The minimum inhibition concentration (MIC) for the acetone extract ranged from 20.0 mg/mL to 160.0 mg/mL, while the ethanol extract ranged from 10.0 mg/mL to 80.0 mg/mL. This indicates that the acetone extract has stronger antibacterial activity against Vibrio sp.[18].

In other studies, the antibacterial activity of Nymphaea alba flowers was tested against Bacillus subtilis, Staphylococcus aureus, Klebsiella pneumonia, and Escherichia coli. Researchers used a hydroalcoholic extract and grew bacterial cultures on Muller Hinton agar. The extract was applied to sterile discs on the plates. The results showed that Nymphaea alba has strong activity against Staphylococcus aureus, Escherichia coli, and Bacillus subtilis, similar to the standard antibiotic gentamycin [47].Nymphaea alba also showed activity against Pseudomonas aeruginosa [48]. Both ethanol and methanol extracts exhibited potent antibacterial activity against ten different bacterial strains using the disc diffusion technique [49].

Another study evaluated the ethanol extract of Nymphaea alba against Listeria monocytogenes infection in mice. The mice were exposed to 100 µl and 200 µl of the pathogen. The infection caused changes in behavior, sunken eyes, eye secretions, hyperactivity, curved spine, sedation, and mortality. The extract helped maintain normal levels of lymphocytes and neutrophils, which usually increase due to infection. It also enhanced platelet production and stabilized white blood cell counts, significantly inhibiting the infection [50].

Anticarcinogenic Effect

Nymphaea alba methanol extract was studied for its protective effects against oxidative stress, kidney cancer, and cell overgrowth in Wistar rats. Two protocols were used: 1. to analyze the preventive effect on kidney oxidative stress caused by ferric nitrilotriacetate and the induction of ornithine decarboxylase. 2. to evaluate the anticancer effect against kidney tumors induced by diethylnitrosamine and ferric nitrilotriacetate.Oral doses of 100mg/kg and 200mg/kg of the extract reduced various parameters and lowered tumor incidence [26].

Another study used the Sulpharhodamine-B assay to test the anticancer activity of Nymphaea alba on four cancer cell lines: THP-1 (leukemia), PC-3 (prostate), A-549 (lung), and HCT-15 (colon). Extracts at 100µg/ml and 50µg/ml were screened for 48 hours. The extracts inhibited cell growth. Chloroform and petroleum ether extracts showed significant effects [3].Several isolated compounds from Nymphaea alba, such as methyl gallate, ethyl gallate, and pentagalloyl glucose, were found to have cytotoxic activity against HepG2 liver cancer cells, with IC50 values of 9.61µg/ml, 41.9µg/ml, and 41.2 µg/ml, respectively, compared to the standard drug doxorubicin (0.56 µg/ml) [36].

The ethanol extract of Nymphaea alba was also tested for antitumor activity using a potato-disc tumor assay induced with Agrobacterium tumefaciens. The extract significantly inhibited tumor growth [49].

Another study evaluated the methanol extract's effectiveness against kidney oxidative stress induced by potassium bromate ($KBrO_3$) and ornithine decarboxylase induction. Rats were pretreated with 100mg/kg and 200mg/kg of the extract before being treated with $KBrO_3$. The extract reduced renal glutathione, antioxidant enzymes, and phase-II metabolizing enzymeswhile increasing xanthine oxidase, glutamyl transpeptidase, lipid peroxidation, and hydrogen peroxide. This suggests that Nymphaea alba can act as a chemopreventive agent against kidney oxidative stress and reduce tumor occurrence in Wistar rats [26].

Antiurolithiatic Activity

The antiurolithiatic (kidney stone prevention) potential of Nymphaea alba was tested using an ethanol extract from dried leaves. The extract was given orally to the test subjects. To induce kidney stones, a zinc disc was inserted

into the urinary bladder, and the subjects were given drinking water with 1% ethylene glycol. The reduction in the weight of the stones was used to measure the effectiveness of the treatment. The results showed that oral administration of Nymphaea alba significantly reduced the weight of bladder stones compared to the control group [25].

Uterotonic Properties

The uterotonic properties of Nymphaea alba rhizomes were investigated using an ethanol extract. Virgin female Wistar rats (120-130 g) were used in the study. To prepare the uterus, 1 mg/kg of stilboestrol was administered subcutaneously. The ethanol extract of Nymphaea alba showed a uterine stimulant effect similar to oxytocin. A dose-dependent increase in uterine contraction force was observed. When oxytocin was present, it enhanced the extract's activity, while atropine and salbutamol inhibited it. This indicates that the extract has uterotonic properties [11].

Anxiolytic Activity

The anxiolytic (anxiety-reducing) effects of the ethanol extract of Nymphaea alba were tested using male albino mice. Various models were used to assess the anxiolytic activity, including the elevated plus maze test, light and dark test, and open field test. Additionally, the foot shock-induced aggression test and rota rod test were used to evaluate aggressive behavior and motor coordination.Two doses of the ethanol extract (100 and 200 mg/kg) were given orally, with 1 mg/kg of Diazepam as the standard. Both doses of the Nymphaea alba extract significantly increased the time spent, percentage, and number of entries in the open arms of the elevated plus maze test. The mice also spent more time in the light box, crossed more, and moved less, indicating reduced anxiety.In the open field test, the extract increased the number of rearings, assisted rearings, and crossed squares. In the foot shock-induced aggression test (FSIAT), the extract reduced anxiety by decreasing aggressive attacks. This suggests that Nymphaea alba has notable anxiolytic properties [22].

Antidepressant Activity

The antidepressant effects of Nymphaea alba flowers were studied in mice using the Tail Suspension Test and Forced Swim Test. Two doses of the ethanolic extract (100 mg/kg and 200 mg/kg) were administered, with Imipramine (10 mg/kg) used as the standard drug for comparison.The results showed that the dose of 100 mg/kg of Nymphaea alba extract reduced the time of immobility more effectively than the higher dose (200 mg/kg) and even more than the standard drug, Imipramine. This suggests that Nymphaea alba flowers have potential antidepressant effects[16].

CNS Depressant Activity

The ethanol extract of Nymphaea alba rhizomes was tested for its CNS depressant activity. Different doses (75 mg/kg, 150 mg/kg, and 300 mg/kg) were given to mice to observe their behavioral effects. Several tests were conducted, including the Diazepam-induced sleep test, holeboard test, beam walking, staircase test, open field test, and elevated plus maze. The results showed that Nymphaea alba rhizome extract has sedative properties similar to those of the standard drug. It produced consistent results across the tests, indicating its potential as a CNS depressant [10].

Anticonvulsant Activity

Researchers studied the ability of Nymphaea alba flower extract to prevent seizures in rats. They used two methods to induce seizures: one with an electroconvulsiometer (MES) and another with a chemical called pentylene tetrazole (PTZ). MES Method: This uses an electroconvulsiometer to induce seizures. PTZ Method: This uses a chemical called PTZ (70mg/kg) injected into the rats. To test the flower extract's effectiveness, they used two standard seizure-preventing drugs for comparison i.e. Phenytoin sodium for the MES method and Sodium valproate for the PTZ method. They gave the rats two different doses of the Nymphaea alba flower extract (200mg/kg and 100mg/kg of body weight) one hour before inducing the seizures. The flower extract significantly prevented the tonic hind limb extension phase (a severe seizure symptom) and reduced the duration of seizures in the MES method. In the PTZ method, the extract showed some protection against seizures but was not statistically significant [17].

Antihyperlipidemic Activity

Researchers studied how Nymphaea alba leaves can help reduce high cholesterol and fat levels in the blood. They used a methanol extract from the leaves and tested it on rats with high blood fat levels induced by a chemical called triton. They used two doses of the extract: 100mg/kg and 200mg/kg, given orally. Triton (400mg/kg) was used to induce high blood fat levels in the rats. Fenofibrate, a known drug for lowering blood fats, was used as a standard for comparison. Results from the tests showed that the Nymphaea alba extract significantly reduced cholesterol levels, along with phospholipids, LDL (bad cholesterol), VLDL, and triglycerides. It also significantly increased HDL (good cholesterol) levels. Total cholesterol levels were reduced by 74.25%, and LDL cholesterol levels were reduced by 32.76% [51].

Antioxidant Activity

Researchers tested the antioxidant properties of Nymphaea alba flowers using two different extracts: aqueous (water-based) and ethanol (alcohol-based). They used several methods to see how well these extracts could neutralize harmful free radicals. They measured Free radical scavenging by H2O2 and How well the extracts neutralize hydrogen peroxide, Total antioxidant activity Overall ability to act as antioxidants, and Nitric oxide (NO) scavenging activitiesHow well the extracts neutralize nitric oxide.The results showed that both extracts have strong antioxidant properties, but the ethanol extract was more effective than the aqueous extract [52].

Another study used a different method (DPPH radical scavenging assay) to test the antioxidant potential of various Nymphaea alba flower extracts (methanol, ethyl acetate, and aqueous). All these extracts showed promising antioxidant capacities [3].

Miscellaneous

Nilofar (Nymphaea alba Linn) has been found to absorb heavy metals like lead, cadmium, and manganese from water at different concentrations and pH levels [53,54]. Manganese, it showed the highest absorption at 3.743 mg/g when the water had a concentration of 5 mg/L and a pH of 6.5. Cadmium, it had the lowest absorption at 0.464 mg/g with a concentration of 1 mg/L and a pH of 5.5 [53]. The roots of Nymphaea alba can also absorb mercury and phenol and filter out microorganisms. This means the plant could be used as a natural filter to remove heavy metals from industrial waste [53,55]. Other observations include the relationship between concentrations of elements like barium, cobalt, and copper [56]. The absorption of chromium by different parts of the plant and its toxic effects. The effects of various factors such as pH, aluminum (Al), and bicarbonate (HCO_3) on the plant's decomposition and leaf composition [57].

Conclusion

Natural products are gaining popularity worldwide because they can cure diseases with few side effects. Modern laboratory techniques have shown that these natural substances are very useful in developing herbal medicines. Many synthetic drugs are actually derived from compounds found in plants and are used for their therapeutic benefits. *Nilofar* (Nymphaea alba Linn), has been used for a long time in traditional medicine specially in the Unani System of Medicine to treat various ailments such as *Sahar* (Insomnia), *Malencholia*, *Humma* (Fever), *Warme kabid* (Hepatitis), *Khafqan* (Palpitation), *Shaqeeqa* (Migraine), *Kasrateatash* (Polydipsia), *Ishaal muzmin* (Chronic diarrhea), *Sue hazm* (Dyspepsia), *Bawaseer* (Piles), *Warme masana* (Cystitis), *Warme gurda* (Nephritis), *Warme ama* (Enteritis) and *Ziyabetus* (Diabetes), etc. Different ethnic groups have proven its effectiveness through their own medicinal practices. Modern research techniques have shown that Nilofar (Nymphaea alba Linn) can help with many health issues, supporting its traditional uses. It has been found to have various benefits, such as antioxidant, anxiolytic, anticonvulsant, hepatoprotective and cancer-preventive properties, etc. While much research has been done on Nymphaea alba, there is still a lot to discover about its potential.

Financial Support

None

Declaration of Competing Interest

The Authors have no conflict of interest to declare

Acknowledgment

None

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