

A REVIEW ON PHARMACOLOGICAL PROFILE OF *NELUMBO NUCIFERA*

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Abstract:-

Nelumbo nucifera, belongs to *nelumbonaceae* family which is also known as the sacred lotus, is an aquatic plant traditionally used for its medicinal properties. Recent research has focused on its potential as pharmacological activity. Its potential as an antihelminthic, particularly for treating parasitic worm infections, which are a major global health issue. Phytochemical studies have identified several bioactive compounds in *N. nucifera*, such as alkaloids, flavonoids, tannins, and polyphenols. The leaf, rhizome, seed and flower are traditionally used for the treatment of pharyngopathy, pectoralgia, spermatorrhoea, eukoderma, small pox, dysentery, cough, haematemesis, epistaxis, haemoptysis, haematuria, metrorrhagia, hyperlipidaemia, fever, cholera, hepatopathy and hyperdipsia. This review will focus on the various pharmacological benefits of using medicinal herbs. The knowledge of herbal plant specially aquatic plant and its pharmacological benefit or medicinal value must have been accumulated in the course of many centuries but it is our misfortune that proper chemical and pharmacological evaluation of most of these plants have not done till now. Keeping this view, details studies on ethno botanical study & pharmacological profile of *Nelumbo nucifera* plant,.

Keywords:-*Nelumbo nucifera*, , *Ascarislumbricoides*, conventional treatments.

1.Introduction:-*Nelumbo nucifera*, now placed in the mono-generic family Nymphaeaceae, has numerous common names (e.g. Indian lotus, Chinese water lily and sacred lotus) and synonyms (*Nelumbium nelumbo*, *N. speciosa*, *N. speciosum* and *Nymphaea nelumbo*).^[1] All parts of *N. nucifera* have many medicinal uses. The leaf, rhizome, seed and flower are traditionally used for the treatment of pharyngopathy, pectoralgia, spermatorrhoea, eukoderma, small pox, dysentery, cough, haematemesis, epistaxis, haemoptysis, haematuria, metrorrhagia, hyperlipidaemia, fever, cholera, hepatopathy and hyperdipsia. In Ayurveda this plant is also used as a diuretic and anthelmintic and in the treatment of strangury, vomiting, leprosy, skin diseases and nervous exhaustion.^[1-2] In popular medicine it is used in the treatment of tissue inflammation, cancer, skin diseases, leprosy and as a poison antidote.^[3,4] Several pharmacologically active constituents that are responsible for the medicinal values have been isolated from the leaf, rhizome, seed and flower. Different classes of phytoconstituents have been isolated from various parts of *N. nucifera*. The most important classes include alkaloids, steroids, triterpenoids, flavonoids, glycosides and polyphenols.^[5-11] Studies on different parts of *N. nucifera* have shown a variety of pharmacological activities. Extracts of different parts have shown anti-ischaemia,^[12] antioxidant,^[13] anticancer,^[10] antiviral,^[14,15] anti-obesity,^[16] lipolytic,^[17] hypocholesterolaemic,^[18] antipyretic,^[19] hepatoprotective,^[20] hypoglycaemic, antidiarrhoeal, antifungal, antibacterial, anti-inflammatory and diuretic activities.^[7,21]

2.Taxonomical classification:-

- Kingdome: Plantae
- Clade: Angiosperms
- Class: Magnoliopsida(Dicotyledons)
- Order: Proteales
- Family: Nelumbonaceae
- Genus: *Nelumbo*
- Species: *Nelumbo nucifera*

3. Physical Characteristics and Morphology:-Large aquatic rhizomatous plant *Nelumbo nucifera* has long, thin creeping stems with nodal roots. Perennial Lotus plants have orbicular leaves that are both airborne and floatin²² . While floating leaves have a flat appearance, aerial leaves are cup-shaped²³. Its petioles have noticeable prickles and are rather lengthy and

tough. Flowers are solitary, hermaphrodite, and range in colour from white to rose. They also have a very fragrant aroma. Flowers are ovoid, glabrous, and have an average diameter of 10–25 cm²⁴. Fruit with seeds is firm, ovoid, and black in colour. The seeds are organised in whorls within the fruit, and as the pod bends down towards the water, the seeds mature and release²⁵. Eight inches long and two inches in diameter make up tuberous roots. The lotus root's smooth, green exterior layer belies its numerous large air pockets inside, which let the tuber float in the aquatic system. These pockets span the length of the tube²⁶.



Fig1: Different parts of plant *Nelumbo nucifera* Flower, Leaf, Seed & Root

3.1 Leaves:-Both varieties of huge leaves are aerial and floating, ranging in size from 20 to 90 cm. The leaves are leathery when they are fresh, but after drying, they become nearly membranous and brittle. The lower surface has some brownish red blotching, and the petioles of the aerial leaves are erect and stout white, while those of the floating leaves are not strong enough²⁷. The diameter is abruptly acute to form a short tip, and they are petiolate, entire glaucous strong cupped in the case of aerial leaves and flat in the case of floating ones, radiantly nerved. For airborne leaves, the typical length is from 24 to 33 cm, while for floating leaves, it is 23 to 30 cm. Petioles are smooth, green or greenish brown in colour with tiny brown spots; they can also be rough with very minute but definite pinches; the fragrance is pronounced; and the fracture is fibrous²⁸. The petiole of the leaf stalk usually exhibits four distinct, big holes in the centre and minor cavities on the perimeter when transversely sliced²⁹.

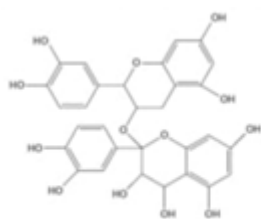
3.2Fruit and seed:-Fruit is a collection of immature nutlets. Ripe nutlets have a firm, smooth, brownish or greyish black pericarp that is pedunculated, one-seeded, and somewhat longitudinally striated³⁰. They are ovoid, roundish, or oblongish, up to 1.0 cm long and 1.5 cm broad. The ripe carpel is filled with seeds³¹. The fruit of *N. nucifera* possesses an amazing ability to remain dormant, and its seeds have been shown to last longer than those of any other flowering plant species. After 150 years of captivity in a glass-topped box, Robert Brown, the first botanist at the British Museum, tested with *Nelumbo* fruits at different periods between 1843 and 1845 and found that they still had the ability to germinate³².

3.3Flowers:-Sepals, petals, and stamens are spirally arranged and gradually pass one into another. Solitary, large, 10–25 cm in diameter, white pink or pinkish white fragrant peduncles arising from the nodes of the rhizomes, sheathing at the base, 1-2 cm long, green or blackish green, hard and stout, smooth or rough due to the presence of numerous small scattered prickles³³.

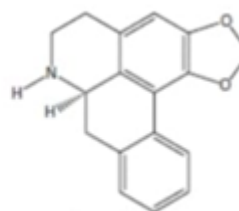
3.4Root:-The epidermal root consists of two cell layers with the thickness of 97.50 - 124.09 μm on average and accounts for 5.91 - 8.29% the root radius. The parenchyma cells have a spongy cortex root, covering the pericycle. The parenchyma's cells are arranged into many inter cellular air spaces, allowing the roots to transport air and to breathe easily in the anaerobic environment³⁴. The innermost part of the cortex is the shell with thick and round cells allocated in consecutive rings to help improving the resistance ability of the root. The roots of lotus plant are very important as 70% of them are used in the form of fresh food³⁵. Twenty percent are used to produce different products like vinegar, root powder, juices, etc. Different scientists have extracted polysaccharides from lotus roots as well as lotus root residues³⁶.

4. Phytochemistry or Chemical Constituents of Leaves:-Combined gas/liquid chromatography–mass spectroscopy has shown that the leaves are rich in a number of alkaloids. In the analysis of non-phenolic fractions of the leaf extract, the major components had retention data and mass spectra identical to those of nuciferine, roemerine, anonaine, pronuciferine and N-nornuciferine. Two benzyloquinoline alkaloids, (+)-1(R)-cocclaurine and (–)-1(S)-norcocclaurine, were also found in leaf extract of *N. nucifera*. Six non-phenolic bases were identified: roemerine, nuciferine, anonaine, pronuciferine, N-nornuciferine and liriodenine and two phenolic bases, armepavine and N-methyl-cocclaurine, were also found in *N. nucifera* leaf extract.^[37] Dehydro- emerine, dehydronuciferine, dehydroanonaine, Nmethylisococclaurine, anonaine, pronuciferine, Nnornuciferine, O-nornuciferine, nuciferine, remerine, roemerine, armepavine, liensinine, isoliensinine, negferine, asimilobine and liridinine were isolated from leaves and petioles. The leaves also contain a glycoside, nelumboside and flavonoids such as quercetin and leuco-anthocyanidin which were identified as leucocyanidin and leucodelphinidin. The presence of some other flavonoids in the leaves such as quercetin 3-O-aarabinopyranosyl-(1!2)- β -galactopyranoside, quercetin-3-O- β -Dglucuronide, rutin, (+)-catechin, hyperoside, isoquer-citri and astragalin has also been reported. Scanning electron microscopy and chemical analysis of the chloroform extract of

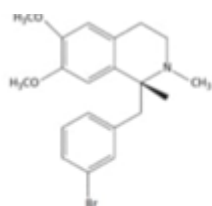
leaves showed that the wax was composed of a mixture of aliphatic compounds, principally nonacosanol and nonacosanediols. Analysis of gas chromatography spectra of lotus leaves waxes showed a much lower proportion of the secondary alcohol nonacosan-10-ol (16.2% by weight) compared with nonacosanediols (64.7%). Gas chromatographic analysis of the extracted leaf waxes revealed nonacosan-10-ol ($16.2 \pm 1.1\%$), triacontan-7-ol ($2.4 \pm 0.4\%$), nonacosane-4, 10-diol ($18.6 \pm 0.5\%$), nonacosine -5, 10-diol ($34.1 \pm 1.9\%$), nonacosane-10, 13-diol ($12.0 \pm 0.7\%$), hentriacontane-12, 15-diol ($1.8 \pm 0.0\%$), tritriacontane-9, 10-diol ($0.7 \pm 0.0\%$) and octadecanoic acid ($0.7 \pm 0.0\%$).



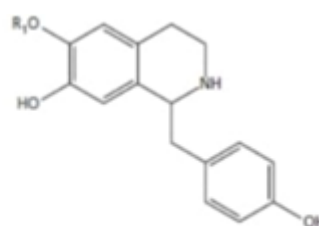
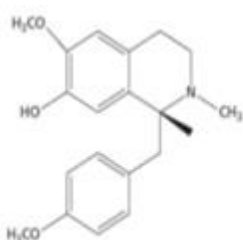
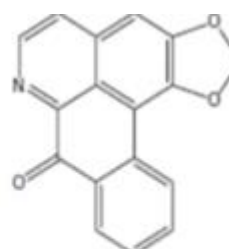
Procyanidin



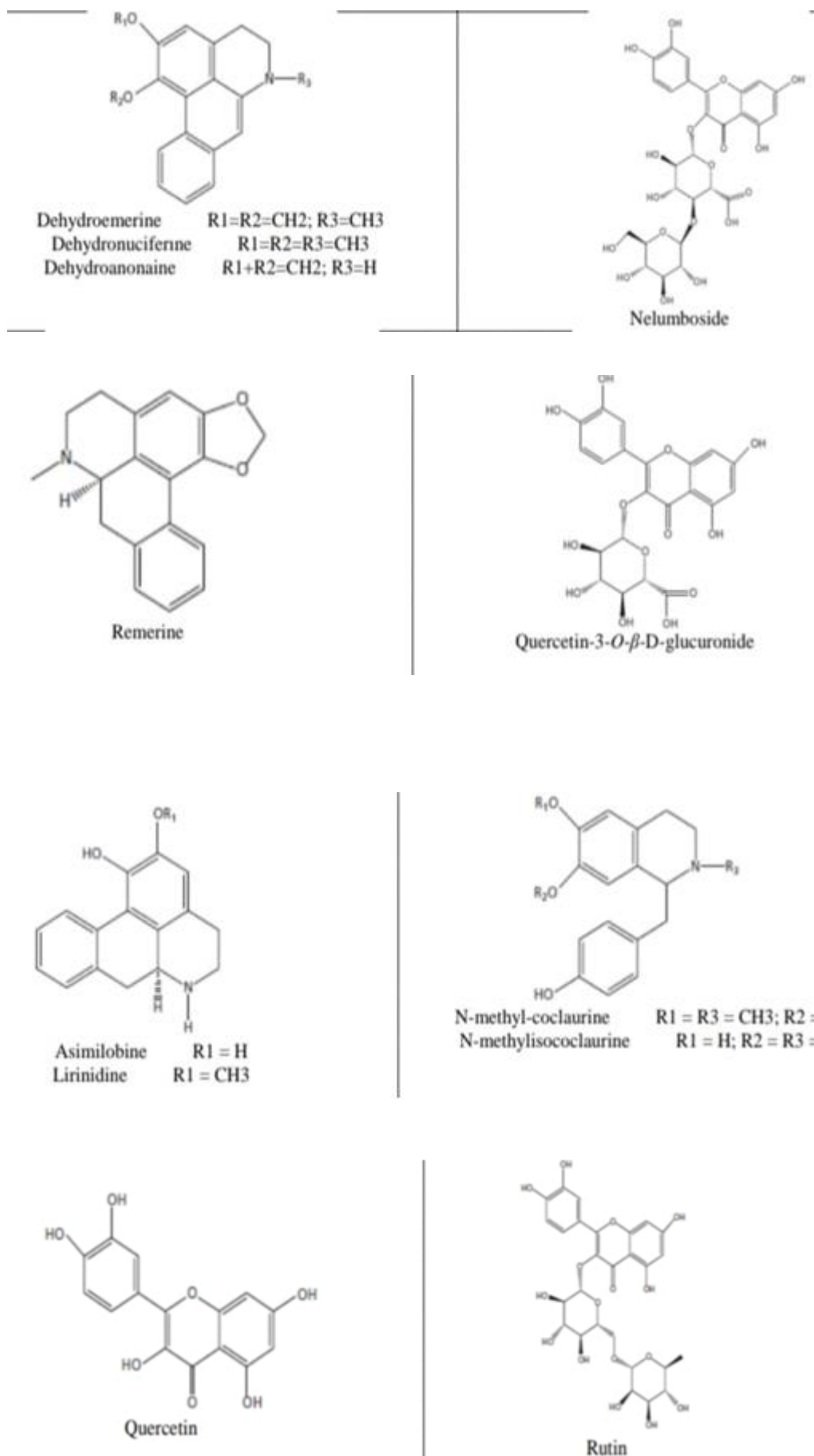
Anonaine



D(-)-3'-bromo-O-methyl-armepavine

Coclaurine
NorcoclaurineR1 = CH3
R1 = HD-1,2,3,4-tetrahydro-6-methoxy-1-(*p*-methoxybenzyl)-2-methyl-7-isoquinolinol

Liriodenine



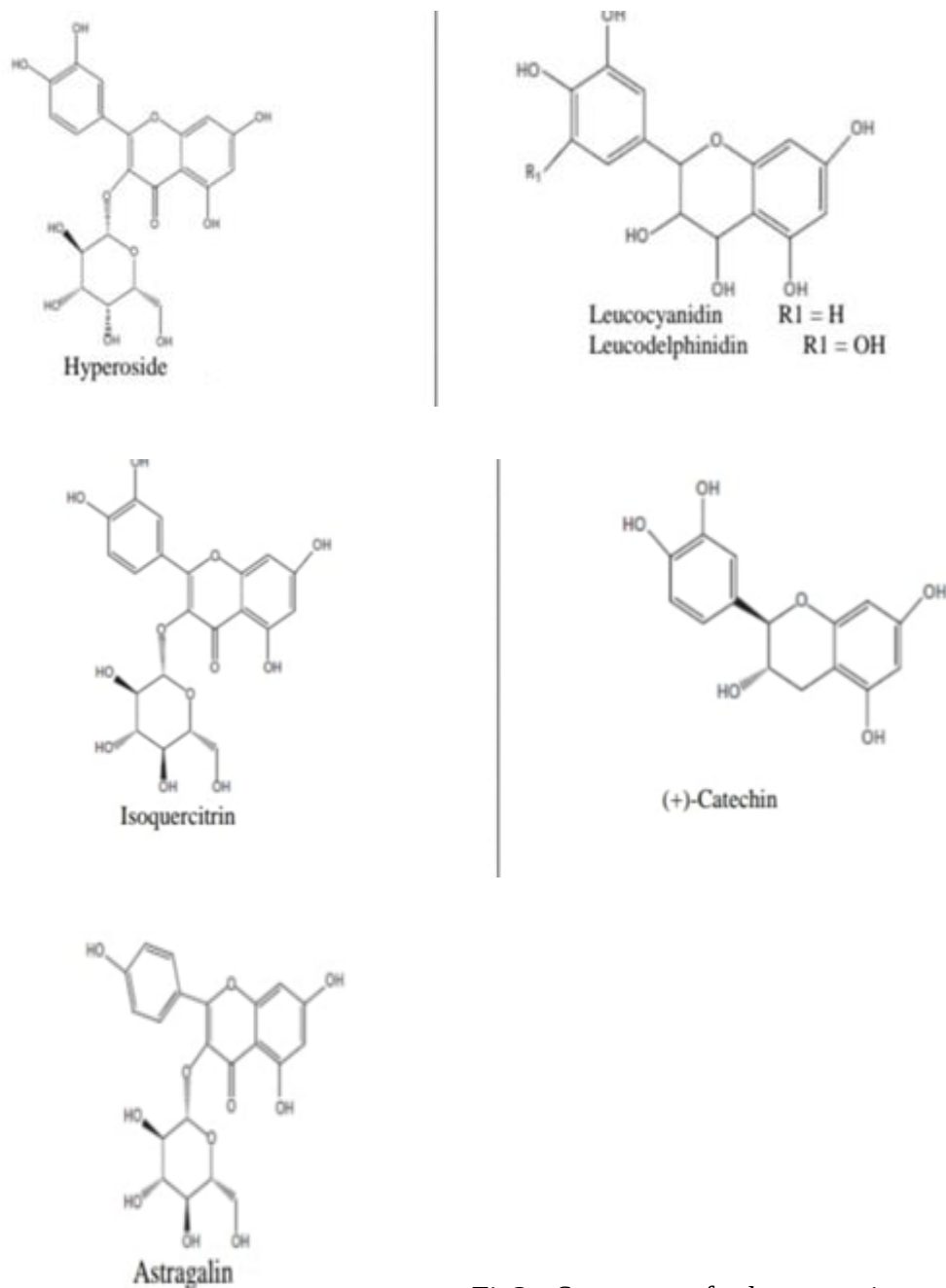


Fig2: Structure of phytoconstituents present on *N.*

nucifera plant

5. Pharmacological profile:-

N.nucifera has been screened scientifically for various pharmacological activities like anti-
 ischaemic activity, antioxidant activity, hepatoprotective activity, anti-inflammatory activity,
 anti-fertility activity, anti-arrhythmic activity, anti-fibrosis activity, antiviral activity,
 antiproliferative activity, antidiarrhoeal activity, psychopharmacological activity, diuretic
 activity, antioxidant activity, antipyretic activity, immunomodulatory activity, hypoglycaemic
 activity, aldose reductase inhibitory activity, antibacterial, aphrodisiac activity, antiplatelet

activity, cardiovascular activity, anti-obesity activity, lipolytic activity, hypocholesterolaemic activity, hepatoprotective activity, anticancer activity.

5.1Seeds:-

I. Anti-ischaemic activity:-

The seed of *N. nucifera* shows potent anti-ischaemic effects in the isolated rat heart. The effective amount of seed extract against ischaemia induced in the isolated rat heart was assessed by measuring cardiac output, blood pressure, aortic flow and coronary flow; doses of 0.1–30 mg/ml were tested. Maximal recovery was seen at a dose of 10 mg/ml, although cardiac output was similar after treatment with 3 or 10 mg/ml doses (63.5 ± 3.2 and 65.8 ± 4.0 ml/min, respectively). Thus, the 3 mg/ml dose was determined to be the optimum dose for anti-ischaemic effects in the rat. *N. nucifera* extract has distinct anti-ischemic effects through calcium antagonism⁽³⁸⁾.

II. Antioxidant activity:-

The ethanol extract of the seed has been evaluated for its antioxidant activity using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical assay. Potent free radical scavenging effects were seen, with a median inhibition concentration (IC₅₀) of 6.49 mg/ml⁽³⁹⁾. Procyanidin and condensed tannin isolated from the seed pod of *N. nucifera* have several pharmacological activities, including lipid auto-oxidation, lipoxygenase inhibition and free radical scavenging comparable to butylated hydroxytoluene (0.1%). At a concentration of 62.5 mg/ml, procyanidin inhibited lipoxygenase activity by more than 90%, with an IC₅₀ value of 21.6 mg/ml¹. Furthermore, the antioxidant activity of the hydroalcoholic extract of seed has been reported using the DPPH and nitric oxide methods. The hydroalcoholic extract exhibited strong free radical scavenging activity, with IC₅₀ values of 6.12 ± 0.41 mg/ml in the DPPH assay and 84.86 ± 3.56 mg/ml in the nitric oxide assay. These values were lower than those of rutin, a standard free radical scavenger. Administration of the hydroalcoholic extract of seed to Wistar rats at 100 and 200 mg/kg for 4 days before carbon tetrachloride treatment caused significant dose-dependent increases in the levels of superoxide dismutase (SOD) and catalase, and a significant decrease in the level of thiobarbituric acid reactive substances. These changes observed at 100 mg/kg were comparable to those observed with vitamin E at 50 mg/kg⁽⁴⁰⁾.

III. Hepatoprotective activity:-

An ethanolic extract of the seed of *N.nucifera* was studied for hepatoprotective effects in carbon tetrachloride and aflatoxin B1- induced hepatotoxicity models. Cell death caused by carbon tetrachloride was significantly inhibited in a dose-dependent manner by the ethanolic extract at concentrations between 10 and 500 mg/ml. The same extract reduced the genotoxicity of aflatoxin B1, showing complete inhibition at a concentration of 250 mg per plate⁽³⁹⁾.

IV. Anti-inflammatory activity:-

The seed extract of *N. Nucifera*, at a dose of 10 mg/kg, inhibited the production of pro-inflammatory cytokine tumour necrosis factor- α (TNF- α) and increased anti-inflammatory cytokine IL-10 in female mice with systemic inflammation induced by an intraperitoneal injection of lipopolysaccharide (LPS)⁽⁴¹⁾. Studies in LPS-challenged mice showed that a high dose of 20 mg/day of seed extract significantly decreased TNF- α levels in the serum and significantly increased the levels of IL-10 produced by peritoneal macrophages.

VI. Anti-arrhythmic activity:-

Neferine, an alkaloid isolated from the seed embryo of *N. nucifera*, has been reported to have anti-arrhythmic effects on rabbit sinoatrial nodes and clusters of cultured cardiac myocytes from neonatal rats⁽⁴²⁻⁴³⁾. Neferine inhibits the slow transmembrane Na⁺ and/or Ca²⁺ current of the myocardium, which leads to its anti-arrhythmic action⁽⁴²⁻⁴³⁾. Neferine causes non-specific inhibition of the Na⁺, Ca²⁺ and K⁺ cardiac transmembrane currents in guinea-pig papillary muscles and atria, which relates to its anti-arrhythmic activity⁽⁴⁴⁾.

VII. Anti-fibrosis activity:-

The inhibitory effect of isoliensinine isolated from the seeds of *N.nucifera* was studied on bleomycin-induced pulmonary fibrosis in mice⁽⁴⁵⁾. Administration of isoliensinine remarkably suppressed the increase in hydroxyproline content and abated the lung tissue injury induced by bleomycin. It enhanced SOD activity and decreased the malondialdehyde level in a concentration dependent manner. Moreover, isoliensinine significantly inhibited the over-expression of TNF- α and transforming growth factor- β (TGF- β) induced by bleomycin.

VIII. Antiviral activity:-

Ethanol extract of the *N.nucifera* seed (100 mg/ml) significantly suppressed replication of herpes simplex virus-1 (HSV-1), with an IC₅₀ of 50 mg/ml. Furthermore, a sub-fraction of *N. Nucifera* has an inhibitory effect on HSV-1. at a concentration of 50 mg/ml inhibited HSV-1 replication in HeLa cells by up to 85.9%, attenuating acyclovir-resistant HSV-1 propagation⁽⁴⁶⁾. In a bioassay-guided fractionation, significantly blocked HSV-1 multiplication in HeLa cells without apparent cytotoxicity. The production and mRNA transcription of infected cell protein was found to be decreased in -treated HeLa cells.

IX. Antiproliferative activity:-

The ethanolic extract of *N. nucifera* seed suppressed cell cycle progression, cytokine gene expression and cell proliferation in human peripheral blood mononuclear cells (PBMC).

5.2 Rhizomes:-

I. Antidiarrhoeal activity:-

The antidiarrhoeal potential of *N. nucifera* rhizome extract has been reported. A study was undertaken to evaluate the effects of methanolic extract of rhizomes of *N.nucifera*. Gaertn for its antidiarrhoeal potential against several experimental models of diarrhoea in rats. The extract produced significant inhibitory effects against castor-oil-induced diarrhoea and PGE₂-induced enteropooling; the propulsive movements of a charcoal meal were also reduced significantly⁽⁴⁷⁾.

II. Hypoglycaemic activity:-

The oral hypoglycaemic effect of *N. nucifera* was demonstrated using an methanolic extract of the rhizome, which markedly reduced the blood sugar level of normal, glucose-fed hyperglycaemic and streptozotocin-induced diabetic rats, when compared with control animals.

III. Psychopharmacological activity:-

The methanol extract of the rhizome of *N. nucifera* produced significant psychopharmacological actions in rats and mice. Reduction in spontaneous activity and a decrease in exploratory behaviour in the head dip and Y-maze tests were reported. Thus, the extract possesses most of the pharmacological characteristics of a minor tranquilizer⁽⁴⁸⁾.

IV. Diuretic activity:-

The diuretic activity of *N. nucifera* rhizome was reported. The methanol extract of the rhizome induced significant diuresis in rats at doses of 300, 400 and 500 mg/kg. There was a dosedependent increase in the volume of urine, with Na⁺ and Clexcretion, accompanied by a significant excretion of K⁺. The increase in volume of urine was less than with the standard diuretic Furosemide (20 mg/kg). There was a significant increase in natriuretic and chloruretic activity but kaliuresis was less than natriuresis⁽⁴⁹⁾.

V. Anti-inflammatory activity
The anti-inflammatory activity of the methanol extract of *N. nucifera* rhizome as well as of betulinic acid, a steroidal triterpenoid isolated from it, were evaluated on carrageenin and serotonin induced rat paw oedema. The rhizome extract at doses of 200 and 400 mg/kg, and betulinic acid at doses of 50 and 100 mg/kg (administered orally) showed significant antiinflammatory activity; the effect was comparable to that of the standard drugs phenylbutazone and dexamethasone⁽⁵⁰⁾.

VI. Antioxidant activity:-

Yang and coworkers have performed in-vitro studies of the antioxidant activity of methanol and acetone extracts of the *N. nucifera* rhizome using the DPPH assay⁽⁵¹⁾. The methanol and acetone extract showed highest DPPH scavenging activity, at 66.7 and 133.3 mg/l, respectively; the methanol extract exhibited a higher antioxidant activity coefficient than ascorbic acid.

VIII. Immunomodulatory activity:-

The immunomodulatory activity of *N. nucifera* rhizome extract was evaluated using various in vivo models including the total and differential leukocyte count (TLC and DLC), nitrobluetetrazolium reduction (NBT) test, neutrophil adhesion test, phagocytic response and delayed type hypersensitivity (DTH) reaction. Sheep red blood cells (SRBC, 5×10⁹ cells/ml)

were used to immunize the animals. Rhizome extract at the doses of 100 and 300 mg/kg was administered. The TLC and lymphocyte

5.3 Flower:-

I. Hypoglycaemic activity:-

Sun-dried flower powder of *N. nucifera*, as well as the aqueous and alcoholic extract of the flower, produced significant hypoglycaemia in fasting normal albino rabbits.

II. Antioxidant activity:-

The potential of *N. nucifera* stamens to scavenge 1,1-diphenyl-2-picrylhydrazyl (DPPH) free radicals and peroxynitrites (ONOO⁻), and the inhibition of total ROS generation by kidney homogenates using dichlorodihydrofluorescein diacetate (DCHF-DA) was examined. The methanol extract showed strong antioxidant activity in the ONOO system and marginal activity in the DPPH and total ROS systems. Similarly, seven known flavonoids were isolated from lotus stamens, most of which also showed potent antioxidant activity⁽⁵²⁾.

III. Antibacterial Activity:-

The hydroethanolic extract of flowers of *N. nucifera* Gaertn in vitro was reported to possess antibacterial activity. The antibacterial activity was screened against different bacterial strains like *Escherichia coli*, *Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Bacillus Subtilis*, *Staphylococcus aureus* by detecting zone of inhibition and minimum inhibitory concentration (MIC).

IV. Antiplatelet activity:-

The antiplatelet activity of hydroethanolic extract of *N. Nucifera* flowers using platelet-rich plasma in different concentrations (100 500µg/ ml) was reported. *N. nucifera* flower extracts showed dose-dependent effective antiplatelet activity with maximum activity at 500µg/ml concentration; prevention of platelet aggregation was 50% of that achieved with standard aspirin⁽⁵³⁾.

5.4 Leaves:-

I. Cardiovascular activity:-

Two alkaloids that act as serotonin antagonists, namely asimilobine and lirinidine, were isolated from the leaves of *N.nucifera*. Both alkaloids inhibited serotonin-induced contractions in isolated rabbit aorta.

II. Antioxidant activity:-

Hydrogen peroxide-mediated cytotoxicity in Caco-2 cells was used to investigate the potential antioxidant activity of the methanol extract from the *N.nucifera* leaf⁽⁵⁴⁾. A dose-dependent protective effect against reactive oxygen species (ROS)- induced cytotoxicity was observed when Caco-2 cells were treated with 10 mM hydrogen peroxide in combination with the methanol extract of the *N.nucifera* leaf (0.1–0.3 mg/ml).

III. Antiviral activity:-

The 95% ethanol extract of *N.nucifera* has been reported to show anti-HIV activity ($EC_{50} < 20$ mg/ml). Some anti-HIV principles, including (+)-1(R)-coclaurine, (–)-1(S)-norcoclaurine and quercetin 3-O- β -D-glucuronide, were found in *N. nucifera* leaves. Both (+)-1(R)-coclaurine and (–)-1(S)-norcoclaurine showed potent anti-HIV activity, with EC_{50} values of 0.8 and < 0.8 mg/ml, respectively, and therapeutic index values above 125 and 25, respectively, whereas quercetin 3-O- β -D-glucuronide was less potent (EC_{50} 2 mg/ml). Other potent anti-HIV bisbenzylisoquinoline alkaloids such as nuciferine, liensinine, negferine and isoliensinine have also been isolated from the leaves of *N. nucifera*, with EC_{50} values below 0.8 mg/ml and therapeutic index values of 36, > 9.9 , > 8.6 and > 6.5 , respectively⁽⁵⁵⁾.

IV. Anti-obesity activity:-

Ono et al reported the effects of leaf extract on digestive enzymes, lipid metabolism and thermogenesis, together with the anti-obesity effect using mice with obesity induced by a high-fat diet. The extract showed a concentration- dependent inhibition of the activities of α -amylase and lipase, and up-regulated lipid metabolism and expression of uncoupling protein-3 mRNA in C2C12 (mouse myoblast cell line) myotubes. It also prevented increases in body weight, parametrical adipose tissue weight and liver triacylglycerol levels⁽⁵⁶⁾.

V. Lipolytic activity:-

A 50% ethanol extract of *N. nucifera* leaves was reported to stimulate lipolysis in the white adipose tissue of mice. Chromatographic analysis of the extract showed that the phytomolecules responsible for lipolytic activity included quercetin-3-O- α -arabinopyranosyl-(1 $\rightarrow$ 2)- β -galactopyranoside, catechin, hyperoside, isoquercitrin and astragalin⁽⁵⁷⁾.

VI. Hypocholesterolaemic activity:-

The aqueous extract of *N.nucifera* leaves was studied for its effects on serum lipids in a rat model. The rats were fed a high-fat diet containing 1.5% cholesterol and 1% cholic acid. Subsequent oral treatment with a crude aqueous extract of lotus leaves resulted in sharp decreases in serum total cholesterol, free cholesterol and phospholipids compared with the highfat- loaded control group^[16]. The effect of *N.nucifera* leaf extract for the improvement of lipid metabolisms and the alleviation of liver damage in high fat diet treatment was studied in hamster model. The effects of flavonoid-enriched *N. nucifera* leaf extract supplement and two lipid-lowing drugs; silymarin and simvastatin, on the disorders induced by high fat diet were investigated. Flavonoid-enriched *N.nucifera* leaf extract supplement may significantly improve the high fat diet-induced abnormal blood lipids and liver damage as significantly as the common drugs^[81].

VII. Hepatoprotective Activity:-

An ethanolic extract of the leaves of *N. nucifera* was studied for its hepatoprotective activity against CCl₄-induced liver toxicity in rat. It was reported that the hepatoprotective activity of *N.nucifera* leaf extract (LLE) at doses of 300 and 500 mg/kg was comparable with that of a standard treatment comprising 100 mg/kg of silymarin⁽⁵⁸⁾.

VIII. Anticancer Activity:-

Methanol and acetone leaf extracts were used for anticancer activity by MTT assay. About 6.25 μ g/mL to 100 μ g/mL of sample was used for MTT assay. Methanol leaf extract showed

27% and acetone leaf extract showed 7% in 100 µg/mL of MCF-7 breast cancer cell line. Both extracts showed less anticancer activity against breast cancer. According to Weng et al. (2009), armepavine (Arm, C₁₉H₂₃O₃N), an active compound from *N. nucifera*, has been shown to exert immunosuppressive effects in vitro. Arm (1-10 µM) concentration dependently attenuated TNF- α - and LPSstimulated α -SMA protein expression and AP-1 activation by HSC-T6 cells without adverse cytotoxicity. Arm also suppressed TNF- α -induced collagen deposition, NF κ B activation and MAPK (p38, ERK1/2 and JNK) phosphorylation⁽⁵⁹⁾.

I X. Antihelminthic activity:-

Both in vitro and in vivo studies have shown that extracts from various parts of the plant, including its leaves, seeds, and roots, possess significantly antihelminthic activity against parasites like *Ascaris lumbricoides* and hookworms. These findings suggest that the plant's compounds may interfere with the growth, development, and reproduction of helminths by disrupting essential physiological functions or inhibiting key enzymes. The antihelminthic properties of *N. nucifera* are further supported by its low toxicity to humans, making it a promising candidate for the development of natural, affordable treatments for helminthiasis. However, additional clinical trials and toxicological evaluations are necessary to confirm its safety and effectiveness in humans. The potential of *N. nucifera* as a treatment for parasitic infections could offer a valuable alternative or complement to current pharmaceutical options, particularly in areas with limited access to conventional treatments.

Activity	Part of plant used
Aldose reductase inhibitory	Flower
Anti-arrhythmic	Seed
Anti- bacterial	Flower
Anticancer	Leaves
Anti-diarrhoeal	Rhizome
Anti-fertility	Seed
Anti-fibrosis	Seed
Anti-ischaemic	Seed
Anti-inflammatory	Seed, Rhizome
Anti-obesity	Leaves
Antioxidant	Leaves, Flower, Rhizome
Antiplatelet	Flower
Anti-proliferative	Seed
Antipyretic activity	Flower, Rhizome
Antiviral	Seed, Leaves
Aphrodisiac	Flower
Cardiovascular activity	Leaves
Diuretic activity	Rhizome
Hepatoprotective	Seed, Leaves
Hypocholesterolaemic	Leaves
Hypoglycaemic	Flowers, Rhizome
Immunomodulatory	Seed, Rhizome
Lipolytic	Leaves
Psychopharmacological	Rhizome

Table 1. Different part of plant & its pharmacological activity

6.Conclusion:-

Nelumbo nucifera, commonly known as the sacred lotus, represents a plant of remarkable botanical, cultural, and pharmacological significance. Through comprehensive taxonomic classification, it has been distinctly identified within the Nelumbonaceae family, showing unique morphological traits that support its evolutionary divergence. Physicochemical analyses have revealed a wealth of bioactive compounds, including alkaloids, flavonoids, and polysaccharides, which contribute to its diverse therapeutic properties such as antioxidant, anti-inflammatory, and hepatoprotective activities. Additional studies encompassing ethno botanical, pharmacological, and molecular investigations further underscore its potential as a valuable resource in both traditional and modern medicine. Continued interdisciplinary research will be vital to unlocking the full pharmacological potential and ensuring the sustainable utilization of this important aquatic plant. The present

article reviews a details study on A review on pharmacological profile of *Nelumbo nucifera* as well as it extracts both possesses the various pharmacological properties and these phyto constituent responsible for medicinal values. It can be stated that traditional Indian medicinal plants have a history of use as herbal treatments. Many Indian plant species have been studied for their ability to treat cognitive problems. Although the different extract of the plant has pharmacological importance but medicinal application and clinical application can be made only after extensive research on its bio-activity, mechanism of action, pharmacotherapeutics and extensive safety studies. It also require to research on pharmacognostical, phytochemical and pharmacological aspect. However research going on it would be easier to develop new drugs after extensive studies on mechanism of action & pharmacological effects. It is expected that it may find application as a novel drug in the future to control various diseases.

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