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PHYTOCHEMISTRY, PHARMACOLOGICAL AND THERAPEUTIC APPLICATIONS OF *NELUMBO NUCIFERA*

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ABSTRACT

Nelumbo nucifera Gaertn. (Nymphaeaceae), also known as sacred lotus, is a well known medicinal plant. Lotus (*Nelumbo nucifera*) has been used throughout Egypt, the Middle East, India, and China since ancient times, primarily as a food, but also as a medicine. The flowers, seeds, leaves, fruit, and rhizomes of the lotus are all edible. The petals of the flower are used as a wrap for foods in Asia, and the rhizome is a common ingredient in soups and stir-fries. Lotus flowers, leaves, seeds, and fruit have been used traditionally to treat a variety of conditions, including diarrhea, abnormal bleeding, poor digestion, fever, and insomnia. There is not enough scientific research on the use of lotus for treatment of any condition. This article reviews the traditional uses, phytochemistry and therapeutic reports on different parts of *N.nucifera* viz. the seeds, rhizomes, leaves and flowers. This review also describes various compounds isolated from different parts of this plant and the therapeutic benefits derived from those phytoconstituents.

KEYWORDS

Nelumbo nucifera, Medicinal plants, Therapeutic applications, Lotus and Thamarai.

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INTRODUCTION

Herbal drugs have become the main subject of attention and global importance since a decade. They are said to possess medicinal, therapeutical and economical implications. The regular and widespread use of the herbal drugs is getting popular in the present era creating new horizons. The *Nelumbonaceae* also known as the lotus family is a small family of perennial, the family is characterized by simple, peltate leaves which lack stipules and are borne on the surface of the water. *Nelumbo nucifera*, also called the Indian or sacred lotus, is found

throughout Asia and Australia (Figure No.1). *N.nucifera* is an important aquatic economic plant, not only as a dainty and ornamental flower but also as a source of herbal medicine with strong antipyretic, cooling, astringent, and demulcent properties[1-3]. The species is of religious significance in South East Asia (hence, the name sacred lotus) and the seeds and leaves are also eaten in this region. Wild lotus populations are an important resource for breeding of cultivated lotus.

Botanical Classification

Kingdom: Plantae – Plants; Sub Kingdom: Tracheobionta – Vascular Plants; Super Division: Spermatophyta – Seed Plants; Division: Magnoliophyta – Flowering Plants; Class: Magnoliopsida; Subclass: Magnoliidae; Super order: Protaenae; Order: Proteales; Family: Nymphaeaceae – Lotus Family; Genus: Nelumbo Adans – Lotus; Species: *Nelumbo nucifera* Gaen. – Sacred lotus.

Botanical description

The sacred lotus is a perennial aquatic plant with rhizomes (often mistakenly called 'roots') that grow in the mud at the bottom of shallow ponds, lakes, lagoons, marshes and flooded fields. It's large, peltate (with the leaf-stalk attaching to the centre, rather than the edge) leaves rise above the water surface on 1 to 2 m long petioles[4-6]. Lotus grows to a height of about 150 cm, with a 3-meter horizontal spread. The leaves can be as large as 60 cm in diameter, while the showy flowers can be up to 20 cm in diameter. The fruits are a conical pod, with seeds contained in holes in the pod.

Leaves are large, of both types, aerial as well as floating orbicular 20-90 cm. in diameter, abruptly acute to form a short tip, petiolate, entire glaucous, non-wettable, strong cupped in case of aerial leaves and flat in case of floating ones, radiately nerved, the fresh leaves are leathery, bout on drying they are nearly membranous and brittle, there is more or less brownish red blotching on the lower surface, petioles of the aerial leaves are erect and stout white those of the floating ones are not strong enough. The usual length varies from 24.00 to 33.00 cm. in case of aerial leaves and 23 to 30 cm in case of floating, petioles are smooth, greenish or greenish brown in color with small brown dots sometimes rough with very small, but distinct princkees, odor is distinct, fracture is fibrous. When transversely cut, the petiole of leaf stalk always shows four distinct, large cavities in the centre and small cavities in the periphery[7].

Fruit is an aggregate of indehiscent nut-lets. Ripe nut-lets are avoid, roundish or oblongish up to 1.0 cm long 1.5 cm broad, with hard smooth, brownish or grayish black pericarp which is faintly longitudinally striated, pedunculated and one seeded. Seeds fill in the ripe carpe[8]. 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 prickles, sepals, petals and stamens are spirally arranged passing gradually one into another[9].

The rhizomes are 60-140 cm long 0.5 to 2.5 cm in diameter, yellowish white to yellowish brown in color, smooth longitudinally striated with brown patches, Nodes and internodes are present. When freshly cut is exudes mucilaginous juice and show a few large cavities surrounded by several larger ones, fracture is tough and fibrous. Odor is indistinct[7].

Habitat

Warm-temperate to tropical climates, in a range of shallow (up to about 2.5 m deep) wetland habitats, including floodplains, ponds, lakes, pools, lagoons, marshes, swamps and the backwaters of reservoirs.

Synonyms

English – Sacred lotus; Hindi – Kanwal, Kamal; Sanskrit – Ambuja, Tamil - Ambal, Thamarai; Padma, Pankaja, Kamala; Bengal – Padma; Gujarat – Suriyakamal; Malayalam – Tamara; French – Nelumbo; German – Indische lotosblume; Persian – Nilufer.

Phytochemistry

N.nucifera commonly known as Lotus and Kamala in Hindi belongs to family *Nymphaeacea*. Presences of various alkaloids have been reported from the entire plant including nuciferine, neferine, lotusine, isoliensinine, quercitin, isoquercitrin and flavinoids. The seeds of *N.nucifera* contain 2-3% oil comprised

of myristic, palmitic, oleic and linoleic acid. Lotus leaf contains several flavonoids and alkaloids, and flavonoids are considered to be one of main components of lotus leaf[10-12]. A recent study has revealed that eight flavonoids and its glycosides are isolated from lotus leaf, including isorhamnetin, kaempferol, quercetin, quercetin-3-O-β-D-xylopyranosyl-1,2-β-D-glucopyranosyl glycosides, astragalin, chrysoeriol-7-O-β-D-glucoside, isoquercitrin and hyperin[13]. Flavonoids from lotus leaf receive the greatest attention and are studied extensively, since they were displayed as a remarkable range of biochemical and pharmacological properties[14, 15].

Nor-nuciferine (I), nuciferine (II), remerine, remerine (III) and armepavine(IV), were isolated from Leaves and petioles[16-21]. Two serotonin antagonistic alkaloids were isolated from leaves of *N.nucifera* like asimilobine and lirinidine. Both alkaloid inhibited contraction of the rabbit isolated aorta induced by serotonin 10, one more alkaloid nelumbine was also reported to be present in leaves and petioles of the plant which acts as a cardiac poison[22].

The leaves also contain nelumboside, a glycoside which on hydrolysis with 5% H_2SO_4 gave one molecule of quercetin, glucose and glucuronic acid. On methylation with CH_2N_2 followed by hydrolysis this glycoside gave 5,7,3,4-tetra-ortho-methyl-I quercetin. The leaves also contain iso-quercetin, and leucoanthocyanidin which were identified as leucocyanidin and leucodelphinidin by conversion into corresponding anthocyanidin chlorides[23]. Several alkaloids have been isolated from the seeds of *N.nucifera*, The loti embryo found to contain liensinine (V) and isoliensinine (CI) from one of the formosan lotus[24-29]. Seeds contained 2.11% oil examined by gas chromatography, urea adductation and UV absorption revealed the presence of myristic acid (0.04%) , palmitic acid (17.32%), oleic acid (21.91%), linoleic acid (564.17%) and linolinic acid (6.19%)[30, 31].

Fresh rhizomes are analyzed and it contains water – 83.80% Fat –0.11%, reducing Sugar-1.56%, sucrose – 0.41%, crude protein – 2.70%, starch- 9.25%, fibre-0.80%, ash –1.10%, calcium- 0.06%. The vitamins are reported to be present are as follows (in mg/100g) thiamine – 0.22, riboflavin – 0.06, niacin – 2.1, ascorbic acid – 1.5. The rhizomes also contain asparagines (2%). The oxalate contents of lotus rhizomes were found to be 84.3mg %[32].

Pharmacology

The genus n*elumbo* is endowed with a number of medicinally important activities antidiabetic, antipyretic, anti-inflammatory, anticancerous, antimicrobial, antiviral and anti-obesity properties [33]. Furthermore, *N.nucifera* flowers are served as healthy beverages to treat hypertension, cancer, diarrhea, fever, weakness, infection and body heat imbalance[34]. It has been widely used in folk medicine for the treatment of various inflammatory and infectious diseases[35].

Antidiabetic effects

An ethanol rhizome extract reduced the blood sugar level of normal rats and glucose-fed hyperglycemic and streptozotocin-induced diabetic rats[36]. In normal rats, the rhizome extract improved glucose tolerance and increased the effectiveness of injected insulin. The activity of the extract was comparable with that of tolbutamide, a sulfonylurea oral hypoglycemic drug, at 73% and 67% in normal and diabetic rats, respectively. Neferine, isolated from the green seed embryo, was comparable with rosiglitazone in enhancing insulin sensitivity and improving fasting blood glucose, triglycerides, and inflammatory cytokines in insulin-resistant rats[37]. The mechanism of action may involve reducing release of tumor necrosis factor-alpha by activating the gamma peroxisome proliferator-activated receptor (PPAR) as well as decreasing insulin compensatory release from pancreatic islet cells. A Chinese herbal formulation decreased abnormal glucose and improved cholesterol, triglycerides, low-density lipoprotein-C (LDL-C), and high-density lipoprotein-C (HDL-C) in rats fed a high-fat diet after 4 weeks of treatment[38, 39]. Potential mechanisms of action include inhibition of intestinal glucosidase, inhibition of lipase, and free radical scavenging activity[38]. Quercetin and glycosides in the leaves

may inhibit lens aldose reductase, an enzyme associated with diabetic complications[40, 41].

Sivasankari S *et al* showed the evaluation of hypoglycemic activity of inorganic constituents in *N.nucifera* seeds on streptozotocin-induced diabetes in rats. The trace elements present in the seed ash might play a direct or indirect role on insulin secretion or action in synergetic manner to maintain normoglycemia[42]. Yumi Tsuruta *et al* revealed that the polyphenolic extract of lotus root (edible rhizome of *Nelumbo nucifera*) alleviates hepatic steatosis in obese diabetic db/db mice. The ameliorative effect of dietary lotus root on hepatic steatosis in db/db mice is attributable to the suppression of hepatic lipogenesis by the lotus root polyphenols[43].

Anti-inflammatory effects

A methanol rhizome extract at dosages of 200 and 400 mg/kg inhibited induced inflammation in rats. The anti-inflammatory activity was comparable with that of phenylbutazone and dexamethasone[44]. Kaempferol, isolated from sacred lotus, reduced the influx of cytokines and reactive oxygen species in aged rat gingival tissues[45]. Isoliensinine isolated from the seeds reduced bleomycin-induced pulmonary fibrosis in mice[46]. The protective effect was associated with antioxidant activity and reduced expression of inflammatory mediators.

Antipyretics

The ethanol extract of stalks of *N.nucifera* was evaluated for its antipyretic potential on normal body temperature and yeast induced pyrexia in rats. The stalk extract showed significant activity in both the models at oral doses of 200 and 400 mg/kg. The stalk extract at a dose of 200 mg/kg was found to produce significant lowering of normal body temperature up to 3 h and at 400 mg/kg it caused significant lowering of body temperature up to 6 h after its administration. In the model of yeast provoked elevation of body temperature the extract showed dose-dependent lowering of body temperature up to 4 h at both the doses and the results were comparable to that of paracetamol, a standard antipyretic agent[47].

Nootropics

Methanolic extract of rhizomes of *N.nucifera* was found to cause significant reduction in spontaneous activity, decrease in the exploratory behavioral pattern by the head dip and Y maze tests, muscle relaxant activity and potentiating of pentobarbitone induced sleeping time[48].

Antiestrogenic effect

Administration of *N.nucifera* to female rats caused estrogen inhibition due to its antiestrogenic nature. The decrease in the weight of ovary and uterus shows antiestrogenic nature of *N.nucifera* since antiestrogenic substance decreases the wet weight of the uterus[49]. The prolonged estrous cycle and diestrous phase observed with the extract suggests the antifertility effect of *N.nucifera* seeds[50]. Cholesterol derived from the different sources is the precursor for the steroidogenesis of ovarian endocrine tissue[51]. The significant increase in the cholesterol level of the group receiving extract indicates that cholesterol was not used for steroidogenesis hence accumulated in the ovary[52]. The decrease in the glycogen content of *N.nucifera* treated uterus confirms the antiestrogenic nature of the drug[53]. Reduction in protein content of the female genital tract of *N.nucifera* treated rats suggests an inhibition of estrogen production[54].

Effects on lipids and obesity

A Chinese herbal mixture containing sacred lotus reduced serum triglycerides and cholesterol in rats fed a high-fat diet[55]. An ethanol leaf extracts stimulated lipolysis in visceral and subcutaneous adipose tissues in mice[56]. The pathway involved the beta-adrenergic receptor mediated in energy expenditure and prevention of diet-induced obesity. The ethanol leaf extract also suppressed body weight gain in mice fed a high-fat diet[56]. A flavonoid-enriched leaf extract reduced blood and liver lipids, lipid peroxidation, release of the liver enzymes AST and ALT, the LDL-C to HDL-C ratio, and lipid accumulation in the liver in a high-fat diet animal model T [57,58]. The effect of the leaf extract on the high-fat–induced lipid metabolic disorder was comparable with results of silymarin and simvastatin treatment. The flavonoids from the leaf extract may

exert antiatherogenic properties by inhibiting vascular smooth muscle cell proliferation and migration[59].

Sacred lotus leaf extract has been used to treat obesity in China. The effects of the leaf extract on obesity, digestive enzymes, lipid metabolism, and thermogenesis were studied in mice induced with a high-fat diet[60]. The extract inhibited intestinal absorption of carbohydrate and lipid by inhibiting alpha-amylase and lipase; up-regulated lipid metabolism in adipocytes; prevented increases in body weight; and increased thermogenesis. An antiobesity herbal product that included sacred lotus inhibited fat accumulation by down-regulating major transcription factors in the adipogenesis pathway and lipid metabolizing enzymes utilized for accumulation of fat in adipocytes[61]. Lotus root hot water extract with taurine supplementation shows antioxidant and hepatic protective effects in high fat diet-induced obese rats[62].

Antiplatelet activity

The hydroethanolic extracts of both white and pink *N.nucifera* flowers possess potent antiplatelet activity limited to primary haemostasis in human blood. The flavonoids present in hydroethanolic extract might have prevented the adhesion and aggregation of platelets besides release of cytoplasmic calcium that stimulates the release of ADP[63].

Cytoprotective effects

The lotus root extracts may contain a variety of the antioxidants, such as carotenoids, lipoic acid, uric acid and others, and they may also contribute to the protective effects of these extracts against the iron-induced cell death observed here. Thus, the aqueous extracts of lotus root are clearly shown to prevent the iron-induced oxidative damage to C6 glioma cells, and suggested to contain potential cytoprotective substance(s), which may be able to protect glial cells against the oxidative damage brought by the abnormal accumulation of iron in the brain, thereby playing a beneficial role for preserving the brain function particularly in elderly people.However, it seems still necessary to determine active substance(s) responsible for the cytoprotective effect of the lotus root extract, and therefore these extracts are now subjecting to a HPLC analysis to identify water-extractable active component(s)[64].

Antianalgesic activity

The methanolic extract of red and white lotus seeds is an effective analgesic agent. While comparing the lotus seed extracts, the white lotus seed at 600 mg/kg body weight revealed higher effect than others[65].

Anti-diarrhoeal activity

The methanolic extract of rhizomes of *N.nucifera* showed significant inhibitory activity against Castor oil induced diarrhoea and PGE2 induced entero-pooling in rats. It also showed significant reduction of gastro-intestinal motility in rats, thus indicating its efficacy as an anti-diarrhoeal agent[66]. The antiviral action can even be enhanced by combining of *Glycyrrhiza glabra* L, *Nelumbo nucifera* Gaertn. and/or *Urtica dioica* L. extracts, indicating different mechanisms of action. Therefore, combinations of these plants are potentially useful in the treatment of diarrhea caused by rotavirus[67].

Immunomodulatory effects

A lotus seed ethanol extract inhibited cell-cycle progression, cytokine gene expression, and cell proliferation in human peripheral blood mononuclear cells (PBMCs)[68]. (S)-armepavine from sacred lotus immunomodulatory activity includes: (1) inhibition of concanavalin A–induced splenocyte proliferation; (2) suppression of cytokine mRNA expression in splenocytes; (3) improved kidney function with reduction of immune complex deposition and glomerular hypercellularity; and (4) reduced autoantibody and T cell-mediated cytokine production in sera.

(S)-armepavine also inhibits interleukin-2 and interferon-gamma transcripts in human PBMCs without direct cytotoxicity[69,70]. Hydroalcoholic rhizome and seed extracts changed total and differential white blood cell counts, improved phagocytosis, and potentiated immune inflammatory reactions[71].

Hepatoprotective effects

Ethanol seed extracts exhibited hepatoprotective effects against production of serum enzymes and cytotoxicity caused by carbon tetrachloride. The

extract also protected against the genotoxic and cytotoxic effects of aflatoxin B1[72]. Armepavine, an active compound in sacred lotus, has antifibrotic effects in rats by activating the anti–NF-kappaB pathway. Armepavine yielded better results compared with silymarin (ie, milk thistle) in reducing certain metabolic parameters in hepatic fibrosis[73]. A dose of 300 and 500 mg/kg of lotus leaf extract in rats was comparable to 100 mg/kg of silymarin against liver-induced injury by carbon tetrachloride[74]. Hepatitis B has been treated with a combination Chinese herbal product containing sacred lotus leaf[75].

Antioxidant effects

The *N.nucifera* had potent therapeutic efficacy in modulating erythrocyte function and structural abnormalities by their remarkable hypocholestrolemic and antioxidant property[76]. Four different chemical analyses document high antioxidant activity from the rhizome knot[77]. A whole rhizome extract had significant scavenging activity for small carbon-centered radicals[77]. A hydroalcoholic seed extract exhibited strong free radical scavenging activity in rats comparable with that of standard vitamin E treatment at 50 mg/kg[76]. Chemical constituents from the seed pod have lipid auto-oxidative, lipoxygenase, and free radical scavenging activity[78]. Lotus germ oil inhibited lipid peroxidation in mice liver and kidney tissues and blocked autohemolysis of mice red blood cells in a dose-dependent manner[79]. High antioxidant activity was also found in the germ oil in a lipid system (ie, lard peroxidation). The phenolic compounds and tocopherols may contribute to the antioxidant activity of lotus germ oil[79]. A leaf methanol extracts exhibited concentration-dependent antioxidant activity against hemoglobin-induced linoleic acid peroxidation, which may be related to its flavonoid content[80, 81]. Studies on the components and properties of the lotus seed epicarp are very scarce[82-84]. Lotus seed epicarp extract as potential antioxidant and anti-obesity additive in Chinese Cantonese Sausage[85].

Anti-infective effects

Ethanol seed extracts inhibited herpes simplex virus type 1 (HSV-1) multiplication in HeLa cells without cytotoxicity by inhibiting gene expression of HSV-1[86]. Alkaloids and flavonoids from a 95% ethanol leaf extract had anti-HIV activity[87]. Antifungal activity against Candida albicans and antimalarial activity was found for various leaf constituents with no observed cytotoxicity[88]. Antibacterial activity is documented for rhizome extracts against *Staphylococcus aureus*, *Escherichia coli, Bacillus subtilis, Bacillus pumilis,* and *Pseudomonus aeruginosa*[89]. A rhizome extract had antifungal and anti-yeast activity comparable with griseofulvin against 5 different strains of fungi and yeast, including *C.albicaus, Aspergillus niger, Aspergillus fumigatus*, and *Trichophytum mentagopyhtes*[89].

Kashiwada *et al*[90] have reported that the liensinine, negferine, and isoliensinine were isolated from the leaves to embryo showing potent anti-HIV activities and the flavonoids; the primary constituents of the petals showed antioxidant properties and antibacterial bioactivities[91]. The leaf methanol, aqueous extracts of *N.nucifera* and green synthesis of silver nanoparticles have the potential to be used as an ideal eco-friendly approach for the control of the *Anopheles subpictus* Grassi. and *Culex quinquefasciatus*[92].

Psychopharmacologic activity

The alkaloids asimilobine and lirinidine, isolated from the leaves of sacred lotus, inhibited the contraction of rabbit isolated aorta induced by serotonin[93]. Neferine from lotus seed embryos may have antidepressant activity as indicated by its anti-immobility effects in mice in a forced swimming test[94]. Neferine is a direct 5-hydroxytryptamine (5-HT) 1A receptor agonist and may inhibit 5-HT reuptake or activation of 5-HT metabolism. The antidepressant effect was comparable with that of maprotiline and imipramine. In mice, a methanol rhizome extract may improve learning and memory by enhancing neurogenesis through increased cell proliferation and cell differentiation in the dentate gyrus of the hippocampus[95]. Sacred lotus seed extract improved scopolamine-induced dementia in

rats by inhibiting acetylcholinesterase activity and inducing choline acetyltransferase expression[96]. One study documented cholinesterase inhibitory activities from sacred lotus stamen-derived compounds[97]. Methanol seed extracts containing neferine inhibited locomotor activity at 50 mg/kg and elicited potent effects at 100 mg/kg. Neferine induced sedation, hypothermia, antifever effects, and anxiolytic effects comparable with those of diazepam but with a different mechanism[98]. Methanol rhizome extracts also have a minor sedative activity[99]. Leaf extract administered to mice attenuated induced and long-term stress and appeared to have adaptogenic activity comparable with that of diazepam[100].

Anti-allergic effects

A stamen methanol extract containing kaempferol inhibited key receptors and attenuated immunoglobulin E–mediated allergic reactions[101, 102].

Antiarrhythmic effects

Neferine antagonized arrhythmias induced by aconitine in rats, calcium chloride in mice, and coronary occlusion-reperfusion in dogs. Neferine's anti-arrhythmic effect may involve blocking human-ether-à-go-go-related gene channels associated with repolarization of the cardiac action potential[103].

Antifertility activity

A petroleum ether extract of seed has been reported to possess anti-fertility activity in female albino mice at the dose of 3 mg/kg. it is blocked the oestrus cycle at the metoestrus stage compared with ethyl oleate (0.1ml/20g).the extract significantly reduced uterine weight and affected the oestrus cycle by blocking biogenesis of ovarian steroids at an intermediate stage[104].

Anti-inflammatory activity

A methanol rhizome extract at dosages of 200 and 400 mg/kg inhibited induced inflammation in rats. The anti-inflammatory activity was comparable with that of phenylbutazone and dexamethasone[105]. Kaempferol, isolated from sacred lotus, reduced the influx of cytokines and reactive oxygen species in aged rat gingival tissues[106]. Isoliensinine isolated from the seeds reduced bleomycin-induced pulmonary fibrosis in mice[107]. The protective effect was associated with antioxidant activity and reduced expression of inflammatory mediators.

Bo Huang *et al* revealed that the In vitro and in vivo evaluation of inhibition activity of lotus leaves against ultraviolet B-induced phototoxicity[108]. The photoprotective capacity of lotus leaf extracts (LLE) may be attributed to their phenolic compounds, such as hyperin, isoquercetin, and catechin rhamnoside[109].

Other effects

N.nucifera leaf extract inhibits neointimal hyperplasia through modulation of smooth muscle cell proliferation and migration. *N.nucifera* can be considered of herapeutic value in the prevention of atherosclerosis because restenosis after percutaneous transluminal coronary angioplasty can be considered a model of "accelerated atherosclerosis[110]. Methanolic extracts from the flower buds and leaves of sacred lotus (*Nelumbo nucifera*, Nymphaeaceae) were found to show inhibitory effects on melanogenesis in theophylline-stimulated murine B16 melanoma 4A5 cells[111].

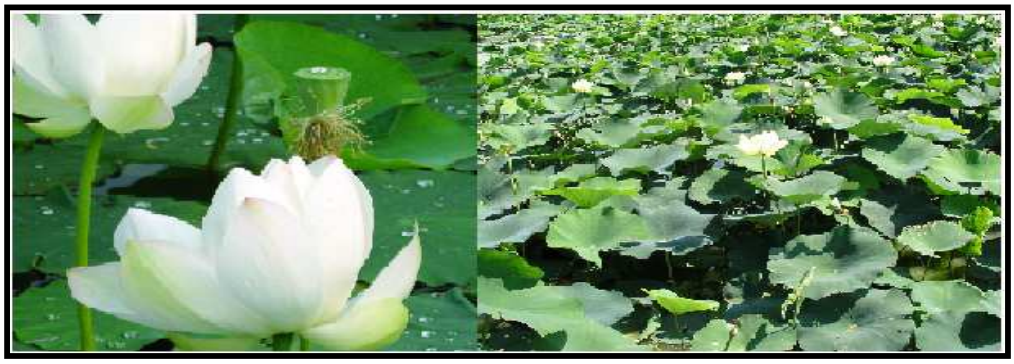

Figure No.1: ***Nelumbo nucifera***

CONCLUSION

Lotus is one of the most popular water plant grown almost in every part of the world. They are astringent, cardiotonic, febrifuge, hypotensive, resolvent, stomachic, styptic, tonic and vasodilator. The leaf juice is used in the treatment of diarrhoea and is decocted with liquorice (Glycyrrhiza spp) for the treatment of sunstroke. A decoction of the flowers is used in the treatment of premature ejaculation. The flowers are recommended as a cardiac tonic. A decoction of the floral receptacle is used in the treatment of abdominal cramps, bloody discharges etc. The flower stalk is haemostatic. It is used in treating bleeding gastric ulcers, excessive menstruation, post-partum haemorrhage. The stamens are used in treating urinary frequency, premature ejaculation, haemolysis, epistasis and uterine bleeding. So, many workers has been performed on the leaves, flowers, seeds, fruits and rhizomes of lotus showed antidiabetic, anti-inflammatory, antipyretics, nootropics, antiestrogenic, effects on lipids and obesity, antiplatelet, cytoprotective, antianalgesic, anti-diarrhoeal, immunomodulatory, hepatoprotective, antioxidant, anti-infective, psychopharmacologic, anti-allergic, antiarrhythmic, antifertility and anti-inflammatory effects. Thus, it would be useful to conduct bioguided chemical investigations on *Nelumbo nucifera* for the purpose of isolating new secondary metabolites for new drug discovery and development.

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