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A Review on Divine Tree Nyctanthes Arbor-Tristis Linn – A Treasure House of Therapeutic Components

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Abstract: ***Nyctanthes arbour-tristis Linn is a short, ancient tree believed to be a divine tree in India. The tree bears beautiful white flowers known for their aura. It is extensively cultivated in tropical and subtropical regions worldwide. Since time immemorial, crude extracts of each part of the tree have been used in classical medicine for the treatment of organ disorders, fevers, infections, as an expectorant, for allergies, gynaecological problems, and various other diseases. Nyctanthes arbour-tristis Linn possesses phytochemicals such as Alkaloids, steroids, Glycosides, flavonoids, Terpenes, essential oils, and proteins that exhibit pharmacological activities like anti-inflammatory, anti-cancer, anti-diabetic, hepato-protective, CNS depressant, anti-anaemic, antipyretic, sedative and many more. This review article provides comprehensive details about the plant, including its distribution, phytochemical constituents, and pharmacological activities. Phytochemical studies and the pharmacological activities of Nyctanthes arbour-tristis Linn. indicate it as a potential medicinal plant for various therapeutic elements. However, more research is crucial to investigate the mode of action of the plant's bioactive constituents and its therapeutic potential.***

Key Words: ***Nyctanthes arbour-tristis Linn, Ancient divine tree, Classical medicine, Organ disorders, phytochemical.***

I. INTRODUCTION

Nyctanthes arbour-tristis Linn (NAT) is one of the most essential medicinal trees known. The flowers of this tree bloom during the night and spread their pleasant fragrance throughout the night [1, 2]. Hence, it is popularly known as "Night Jasmine".

The generic name 'Nyctanthes' is taken from two Greek words: 'Nykhta' meaning 'Night', and 'Anthos' meaning 'flower' [3, 4]. The specific name 'arbour-tristis' means 'the sad tree' because the tree loses all its brightness and looks dull during the daytime.

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Nyctanthes arbour-tristis, a large shrub that grows up to 10m tall, has flaky grey bark, young branches, and rough leaves [5], and beautiful white flowers with an orange tube. It is often seen growing near temples, as it is considered a divine tree.

Different parts of *Nyctanthes* arbour-tristis leaves, flowers, fruits, bark, root, and seeds had been investigated, which revealed critical pharmacological activities hidden within and exposed potential phytochemicals such as alkaloids, flavonoids, steroids, terpenoids, saponins, essential oils and phenolic compounds [6, 7]. The crude extracts, which have been used since ancient times, and the pure bioactive components being tested on various laboratory models have the potential to treat a wide range of diseases, from acute ailments to chronic diseases. This signifies its major applications in the medical field. The aromatic flowers can also be commercially exploited in the manufacture of perfumes, and their bright orange tube is used in the dyeing of fabrics. It is noted that *Nyctanthes arbour-tristis is currently listed as an endangered species according to the IUCN Red Data Book*. Therefore, it is crucial to safeguard this species, and further steps need to be taken for its micropropagation.

II. SCIENTIFIC CLASSIFICATION

Kingdom: Plantae.
Division: Magnoliophuta
Class: Mannoliopsida
Order: Lamiales
Family: Oleacea.
Genus: Nyctanthes
Species: arbor-tristis
Binomial name: Nyctanthes arbor-tristis Linn.

A. Vernacular Names of Night Jasmine in India

Bengali – Harisinghar, Sheoli
Guajarati – Jayaparvati, Parijatak
Hindi – Harisinghar, Sihavu
Kannada – Goli, Parijatha
Konkani – Pardik, Parzonto
Malayalam – Mannappu, Pavizhamalli
Marathi- Kharbadi, Khurasli
Oriya – Godokodiko, Singaraharo
Punjabi – Harisinghar
Sanskrit – Parijatah, Siphalika
Tamil – Manjhapu, Pavala-malligai
Telugu – Kapilanagadustu, Pagadamalle
Urdu – Gulejafari, Harisinghar

III. SIGNIFICANCE OF PARIJATA TREE IN HINDU MYTHOLOGY

Nyctanthes arbour-tristis holds great significance and is associated with sacred beliefs in Hindu mythology. One of the mythological stories tells that when the Gods and demons were performing the Samudra Manthan, the Parijata tree came along with many other things. It bore beautiful white flowers with a divine fragrance. Lord Indra took this tree, gifted it to his wife Indrani and planted it in his garden in Indrapuri. Hence, this tree is considered. The Tree of the Universe, Parijata, was brought by Arjuna (one among the Pandavas), son of Indra and Kunti, to Earth. Kunti used to worship Lord Shiva by offering these flowers to him. Hence, it is called the 'Jewel of God'. According to one mythology, the tree originated from the ashes of Kunti.

In Harivansh Puran, the tree is referred to as the 'Kalpa-vriksha'. This is known as the wish-bearing tree, and therefore, newly married couples are advised to worship this tree and seek blessings from it to ensure eternal love and marital bliss.

The flowers of this tree bloom at night and fall to the ground without any external force. Therefore, these are the only flowers that can be offered to God, even if they are picked up from the ground.

A. Morphological Characteristics of Nat

LEAVES: Leaves are oppositely arranged, simple, with an upper surface that is dark green and has a rough texture, and a lower surface that is light green and has a soft texture. It has reticulated venation with an entire margin [8, 9, 10].

FLOWERS: Flowers distinctly grow at the tips of branches in clusters of 2 to 7 [29]. They are small, bright, with a white corolla and an orange centre. Individual flowers open at dusk and fall off at dawn [11, 12].

FRUITS: Fruits are laterally compressed, bilobate, brown, heart-shaped to round capsules (2 cm) in diameter, each lobe containing a single seed [13, 14, 15, 16, 17, 18].

SEED: Seed is compressed and one per cell [19]. Seeds are exalbuminous, testa thick, the outer layer of large transparent cells and heavily Vascularised [20, 21, 22, 23, 24, 25].

BARK: NAT grows up to 10m (33 ft) tall, with quadrangular branches. The bark is dark grey or brown, rough, and firm. The bark surface is deeply pitted due to the scaling off of the bark by circular flakes. Inner bark is creamy white, soft, and collapsed, and no collapsed phloem zone is distinctly visible [26].

B. Phytoconstituents from Different Parts of Nat

Plant parts	Phytoconstituents
Leaf	Steroids- B-sitosterol, D-mannitol, Astragaline, Nicotiflorin, Oleanolic acid, Nyctanthic acid, Tannic acid, Ascorbic acid, Methyl salicylate, Volatile oil, Friedeline Label, Mannitol, Glucose [27, 28]. Glycosides - Flavanol Glycosides - astragaline, nicotiflamine. Eroded Glycosides - arborsides A, B, C, 6 B hydroxyloganin, Desshamnosylverbacoside, 6,7-Di-Obenzovynycthanoside, 6-0-trans-cinnamoyl-6B-hydroxyloganin, 7-0 transcinnamoyl-6B – B-hydroxyloganin [29, 30]. Flavonoids – Nicotiflorin [31, 32] Terpenes - Triterpenes -B-amysin, oleanolic acid, friedeline, lupeol [33, 34].
Stem	Steroids - B-sitosterol [35, 36] Alkaloids - Nactanthine [37, 38] Glucosides - Naringenin-4'-OB-glucopyranosyl A-xylopyranoside [39, 40]
Flower	Glucosides - Cardiac glycoside nymphaea Irridoid Glycosidesarbotristoside C, 6B hydroxy loganin, 6-0 trans-acetyl-7-Ocinnamoyl 1 - 6 B hydroxyloganin, nyctanthoside, isoarborside C [56]. Flavanoids – Quercetin, kaemferol, Apigenin, Anthocyanin (flower oil) [41, 42] Terpenes - Diterpene – Nyctanthin, A-pinene, p-cymene (flower oil) [43, 44]
Seed	Steroids - B-sitosterol [45, 46] Glucosides - Phenylpropanoid Glycoside – Nyctoside A Eroded Glycosiderarbortristosides A, B, C, D, E [47, 48] Terpenes - Triterpenes - 3, 4 secotriterpene acid, nyctanthic acid [49, 50]

IV. PHYTOCHEMICAL AND PHARMACOLOGICAL STUDY OF NAT

The leaves of NAT have various applications in curing a wide range of diseases, but further research is needed to reveal more phytochemical and pharmacological properties. The purification and extraction of an antioxidative polysaccharide from its leaves using water showed the presence of a highly branched polysaccharide containing esterified phenolic acids, as indicated by chemical, chromatographic, and spectroscopic analyses. ESMS analysis of per-acetylated oligomeric fragments derived by Smith degradation furnishes crucial structural information on a spectrum of glycerol-tagged oligosaccharides. This poly saccharide exhibited a dose-dependent free radical scavenging ability, as evidenced by the DPPH and Ferric reducing power assays. This pharmacologically active compound formed a water-soluble complex with bovine serum albumin. This could incorporate an innovative approach in phototherapeutic management [51].

A fungus of NAT-PM0409092, the cytotoxic compound Altersolanol A, an anthraquinone derivative, was isolated. The Fungus was identified as a Phomopsis species through DNA amplification and sequencing of the ITS region. Through 2D NMR spectroscopy and other spectroscopic data, the chemical structure of Altersolanol A was elucidated, providing insight into its physicochemical properties. The compound exhibited cytotoxic activity against 34 human cancer cell lines, with mean IC50 (IC50) values of 0.005 µg mL-1 (0.024 µg mL-1).

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A kinase inhibitor, Altersolanol A, induces cell death by apoptosis through the cleavage by Caspase 3 and Caspase 9 and also by decreased anti-apoptotic protein expression. This study confirms the cytotoxic effect of Alterosolanol A, isolated from the endophytic *Phomopsis species* of NAT. This study also indicates the utilisation of Alterosolol A for the development of Chemotherapeutics [52].

The analysis of the n-alkane profile of epicuticular wax that was extracted from mature leaves NAT revealed hentriacontane (n-C31), tritriacontane (n-C33), tetratriacontane(n-C35) and nonacosane (n-C29) as the essential constituents, with tritriacontane (n-C33) being the presiding constituent. The collective percentage of these four alkanes exhibited phenological variation, being elevated during the fruit ripening stage (average value 63.29%), followed by the flowering stage (mean value 60.74%)

For the rest of the year, it exhibited moderate values, around 54.31%. The study authenticates the xerophytic features of plants having a greater portion of longer carbon chain n-alkanes greater than C31[12]. The orange-coloured tubular calyx of the NAT flower contains a carotenoid aglycone, Ag-NY1, which was isolated for a comprehensive spectroscopic study of its structure. This study revealed that the carotenoid molecule is Crocetin, a crucial aglycone found in the stigma of Crocus sativus. The compound manifested a good membrane stabilizing activity as compared to the corresponding glycoside, Crocin [53].

A. Classical Uses of Nyctanthes Arbour-Tristis

Plant Parts	Treatment
Leaves	Anti-helmintic, antimicrobial, antidote to reptile Venoms, spleen diseases, sciatica, fungal skin infections, arthritis, dry cough, liver disorders, diabetes, piles, malaria, gynaecological problems.
Flowers	mouth ulcers, expectoration from lungs, gout, ophthalmic purposes, and in preventing greying of hair and baldness or hair-related problems
Bark	Rheumatic joint pain, bronchitis, snakebite, and Malaria
Seeds	Scalp scurvy, alopecia, skin diseases, anti-helmintic, piles, bilious fever.
Roots	Antihelmintic

B. Therapeutic Applications of Nyctanthes Arbour-Tristis Linn:

The table below provides a brief overview of the parts of plants, their extracts, and the therapeutic applications of NAT. Studies have been conducted on various parts of plants, including leaves, stems, flowers, and seeds. Phytochemicals are extracted using multiple chemical compounds, such as ethanol, methanol, ethyl acetate, and Chloroform. They have been successfully tested on experimental models using in vitro and in vivo techniques, which have helped reveal their potential therapeutic effects.

Plant Part	Extract	*In vitro/ In vivo study*	Therapeutic Application
Fruit, Leaf, Stem	Methanol	*In vitro (Cell lines)*	Anticancer
Stem Bark, Root	Ethanol Methanol	*In vivo (Rat)*	Antidiabetic
Leaves	Ethanol Petroleum ether	*In vitro*	Analgesic
Whole plant Stem, Leaf	Aqueous Alcoholic	*In vivo (Rat)*	Anti-inflammatory
Leaves, flowers, fruits, seeds	Chloroform and ethyl acetate	*In vitro*	Antimicrobial
Leaves, Seeds Leaves	Alcoholic and Aqueous Methanol	*In vitro* *In vivo (Albino-Wister rat)*	Hepato-protective activity
Stem, Bark, Leaf	Petroleum ether Chloroform and ethanol	*In vitro*	Antifungal
Leaf	Aqueous	*In vivo (Swiss Albino mice)*	Immunostimulant
Whole plant	Aqueous	*In vivo (Mice)*	Anticholinesterase activity
Leaves and stems	Ethanolic	*In vitro*	Antioxidant
Leaves	Alcoholic	*In vivo (Guinea pig)*	Anti-allergy
Dried leaf, flower, fruit, seed	Ethyl acetate and chloroform	*In vitro*	Antibacterial
Flowers Leaves	Chloroform 50% Ethanol	*In vitro* *In vivo (Mouse)*	Antifilarial
Leaves	50% Ethanolic	*In vitro and* *In vivo (Swiss mice)*	Anti-trypanosonal
Seeds	Iridoid glucoside	*In vitro and* *In vivo (Hamsters)*	Anti-Leishmanial activity
Leaves, flowers, seeds, and bark	Ethanol	*In vitro*	CNS depressant
Dried plant parts	Hydro alcoholic	*In vitro*	Anti-anxiety
Leaves	Methanol and chloroform	*In vivo (Human trial)*	Anti-malarial
Leaves, flowers, bark, seeds	Ethanolic	*In vivo (Rat)*	Anti-anaemic
Leaves	Alcoholic	*In vivo (Guinea pig)*	Anti-histaminic Anti-tryptaminergic
Leaves	Ethanol	*In vivo (rat, Swiss albino mice)*	Antinociceptive and Anti-pyretic
Seeds	Ethanolic	*In vivo (Mice)*	Anti-viral
Leaves	Alcoholic	*In vivo (Albino rabbits)*	Tranquillizing, Anti-histemic, Purgative
Flowers	Aqueous	*In vivo (Male rats)*	Sedative effects
Bark	70% Methanol	*In vivo (Adult male albino rat)*	Anti-spermatogenic
Fruit	50% ethanolic	*In vivo (Adult albino rat)*	Anti-stress
Flower	Aqueous	*In vivo (Adult male mice)*	Hypoglycaemic and hypolipidemic activity

V. THERAPEUTIC APPLICATIONS IN DETAIL

A. Anticaner

The methanol extracts of leaf, stem and fruit of NAT were examined for *in vitro* anticancer activities. At a concentration of 30 mg/ml, with 71% inhibition of dried NAT leaf methanol extract, the extract exhibited moderate activity, and at a concentration of 10 mg/ml. With it86%, itinhibition exhibited the least inhibitory activity of breast cancer cells free of pathogens [54,55]

B. Anti Diabetic Activity

The chloroform extract of flowers, leaves, and ethanolic extract of leaves remarkably increase superoxide dismutase and catalase levels and cause a notable depletion in liver lacto peroxidase, serum levels of SGPT, SGOT, alkaline phosphatase, cholesterol, and triglycerides, in contrast to diabetic controls. Also, Ethanol extract of stem bark possesses outstanding anti-diabetic activity when treated with streptozotocin, nicotinamide induced diabetic rats [56, 57]

C. Analgesic Activity

It was established from the percentage inhibition index that the ethanolic extract of NAT exhibited finer analgesic activity than the aqueous extract when juxtaposed with the standard drug Aspirin [53]. Petroleum ether and β-Sitosterol from NAT leaves could be accountable for analgesic activity [58, 59, 60].

D. Anti-Inflammatory Activity

The aqueous extract of the entire plant, as well as the alcoholic extracts of the stem, seeds, and leaves of NAG, have been reported to exhibit acute and subacute anti-inflammatory activity. The acute anti-inflammatory activity is evaluated in inflammatory models using different phlogistic agents, including carrageenan, formalin, histamine, and 5-hydroxytryptamine, as well as hyaluronidase, in the hind paw of rats. In subacute models, *N-arbortristis* was found to inhibit granulation tissue formation.

NAT is also found to significantly impede the inflammation produced by immunological methods, such as Freund's adjuvant and the purified protein derivative (PPD) reaction.

E. Anti-Microbial Activity

Leaves, bark, and seed oil exhibit a wide range of antibacterial activity against both Gram-positive and Gram-negative microorganisms, including Streptomyces lines. The aqueous and methanol concentrates of the developed leaves of NAT have been investigated for bactericidal activity against Escherichia coli, Staphylococcus aureus, Bacillus subtilis, and Pseudomonas aeruginosa. The two extracts had been vivaciously contradictory to the microscopic organisms, apart from *P. aeruginosa,* which became impermeable to the. fluid extract

F. Hepatoprotective Activity

The leaves and seeds of NAT aqueous extracts were found to have anti-hepatotoxic activity against carbon tetrachloride-induced hepatotoxicity. Additionally, it was confirmed that alcoholic and aqueous extracts exhibited crucial hepatoprotective activity by decreasing the volumes of serum glutamic pyruvic transaminase (SGPT), serum glutamic oxaloacetic transaminase (SGOT) and serum bilirubin. The results were established by histopathological studies of liver samples, which showed regeneration of hepatocytes by the extracts.

G. Antifungal Activity

Ethanol, chloroform, and petroleum ether extracts of stem bark is found to have prospective antifungal activity against Aspergillus Niger and Candida albicans. Leaf extracts are efficacious in decreasing the radial growth of three fungal pathogens of rice, *Rhizotonia solani, Pyricularia oryzae* and *Cochliobolus miyabeanus*.

H. Immuno-Stimulating Activity

Aqueous leaf extract of NAT is a formidable immunostimulant, as exhibited by both humoral and cell-mediated responses [10]. Flowers exhibited immunomodulator activity by activating the cell-mediated immune system [27]. Also, the ethanolic extracts of root and seed displayed immunostimulant activity against systemic candidiasis in mice.

I. Anticholt Nestepase Activity

The aqueous extract of NAT stimulated the activity of acetylcholinesterase in mice and reversed the inhibition of this enzyme by malathion. Elevated effects were perceived in the serum rather than in the brain. Low anti-muscarinic activity against acetylcholine-induced contractions of isolated rabbit ileum was already reported.

J. Antioxidant Activity

Leaves and stems of NAT play a crucial role in furnishing herbal antioxidants. Phytochemical screening of the ethanolic extract of the stem and leaves of NAT disclosed the presence of flavonoids, tannins, saponins, glycosides, alkaloids, steroids, and phenolic compounds. Phenolic compounds were identified as antioxidant agents that act as radical terminators and are known to display medicinal properties and exhibit physiological functions. The inspiring sequel to NAT, with various in vitro antioxidant tests, demonstrated that the plant acts as a reducing agent and a dynamic scavenger of hydrogen peroxide and free radicals. The comprehensive antioxidant properties of NAT could be attributed to its polyphenolic content and other phytochemical constituents.

K. Anti-Allergic Activity

The pre-treatment of guinea pigs exposed to histamine aerosol with a water-soluble section of alcoholic extract of NAT leaves furnished outstanding protection against the development of asphyxia. Arbortristoside A and Arbortristoside C present in NAT were reported to be Anti-allergic.

L. Antibacterial Activity

The antibacterial potential of NAT was assessed against gram-positive bacteria, Staphylococcus aureus, and gram-negative bacteria, including Escherichia coli, Klebsiella pneumoniae, and *Pseudomonas aeruginosa*. The dried leaf, flower, fruit, and seed extracts, prepared in ethyl acetate and chloroform, were utilised to evaluate their anti-bacterial activity in terms of the zone of inhibition of bacterial growth. These activities of plant parts

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were due to the existence of diverse plant secondary metabolites, viz. Glycosides and phenolics. The ethanolic and hydroalcoholic extracts of the leaves were also evaluated for their antibacterial performance against both antibiotic-resistant and non-resistant strains of Staphylococcus aureus. A benzo-furanone, 3, 3a, 7, 7a, tetrahydro-3ahydroxy-6(2H) benzo-furanone was remoted from flowers. The compound exhibited remarkable antibacterial activity against both Gram-positive and Gram-negative bacteria.

M. Antifilarial Activity

The chloroform extract of the flowers and a pure compound isolated from the NAT plant displayed larvicidal activity against *Culex quinquefasciatus*, a habitual filarial vector.

N. Anti-Trypanosomal Activity

A crude 50% ethanolic extract of NAT leaves was assessed in Vitro and *in vivo* for Anti-Tripanosomal activity. The extract exhibited trypanocidal activity at the highest concentration tested (1000 µg/mL).

O. Anti-Leishmanial Activity

The Anti-Leishmanial activity of NAT has been attributed to iridoid glucosides, Arboristosides A, B, and C, and 6β-hydroxyloganin. The Arbortristoside and 6β-hydroxyloganin exhibited both in vitro and in vivo anti-Leishmanial activity against amastigotes in macrophage culture and hamster test systems.

P. Cms Depressant Activity

It was recorded that the leaves, flowers, seeds, and bark of NAT displayed noteworthy concentration dependent extension of onset and duration of sleep and found to cause decrease in dopamine and increase in serotonin level from which it can be set on that CNS depressant activity of ethanol extract of seeds, leaves and flowers could be due to decrease in dopamine and increase in serotonin level.

Q. Anti-Anxiety Activity

NAT hydroalcoholic extracts have anxiolytic potential. Utilising a hydro-alcoholic blend, the dried plant parts of NAT were extracted, concentrated by distilling off the solvent, and then evaporated to dryness on a water bath. The extract was then stored in an airtight container in the refrigerator until used.

R. Antimalarial Activity

A clinical study was undertaken on 120 patients with malaria. A fresh paste of medium-sized five leaves of NAT was administered three times a day for 7 to 10 days, which cured the disease in 92 (76.7%) patients within 7 days. An additional 20 patients were cured within 10 days, while the remaining eight patients did not respond to the treatment. The paste was well tolerated, and no reverse side effects were recorded—screening of methanol and chloroform extracts of leaves for mosquito larvicidal activity against three major mosquito vectors. Aedes aegypti, Culex quinquefasciatus, and Anopheles stephensi have been found to kill larvae of A. stephensi with LC50 values of 244.4 and 747.7 ppm, respectively.

S. Anti-Anaemic Activity

Research was conducted as a haematological study on the ethanolic extracts of the flowers, barks, seeds, and leaves of the plant, observing a concentration-dependent rise in haemoglobin content and red blood cell count in rats. The extracts also protect against the decline of the hemogram profile in anaemic rats.

T. Anti-Histaminic and Anti-Tryptaminergic Activity

The aqueous soluble of alcoholic extract of NAT leaves (4.0 and 8.0 g/Kg) significantly protects against histamine aerosol-induced asphyxia (2% @ 300mm Hg) in guinea pigs. Arbortristoside A and Arbortristoside C, present in NAT, have been reported to exhibit anti-allergic properties.

U. Anti-Nociceptive and Antipyretic Activity

Antipyretic sequel against brewer's yeast-induced proxies in rats was indicated. When administered orally for six consecutive days in rats, it generated dose-dependent gastric ulcers. The water-soluble fraction of the ethanolic extract of the leaves exhibited crucial aspirin-like anti-nociceptive activity, as evidenced by the inhibition of acetic acid-induced squirming in albino mice. However, this effect deteriorated to evoke morphine-like analgesia, as demonstrated by the tail flick and mouse tail-clip methods.

V. Anti-Viral Activity

The ethanolic extract, n-butanol portions, and two pure compounds, Arbortristoside C, removed from NAT, acquire distinct inhibitory activity against Encephalomyocarditis virus (EMCV) and Semliki Forest Virus (SFV). The in vivo ethanolic extract and n-butanol fraction, administered at day-to-day doses of 125 mg/kg body weight, protected EMCV-infected mice against SFV by 40% and 60%, respectively.

W. Tranquilizing Antistaminic & Purgative Activity

Comprehensive research was undertaken with the water-soluble portion of the alcoholic extract of leaves of NAT for certain CNS activities (namely hypnotic, tranquillizing, local anaesthetic, hypothermic, anticonvulsant), antihistaminic and purgative activities. The results were found to align with those of typical tranquillizers, thus bolstering the use of the plant by Ayurvedic physicians in the conditions mentioned above.

X. Sedative Effect

The sedative potential of a hot Infusion of the blossoms was assessed in rats. Male rats exhibited concentration-dependent sedative activity, while females remained unaffected. At these doses, muscle strength and cardiorespiratory function were not affected, nor were blood glucose levels affected, even at the excessive dose. However, glucose absorption from the small intestine was notably diminished; the sedation was credited, in part, to the antioxidant and membrane-stabilising properties of the extract.

Y. Antistress Activity

Antistress potential was examined in the fruit of NAT. The water-soluble fraction of a 50% ethanolic extract of the fruit was administered to adult albino rats. It reversed the stress-induced biochemical changes.

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Z. Antispermatogenic Effect

The bark of NAT was utilised for testing its antispermatogenic effect. 70% methanol extract of bark was administered to adult male albino rats in vivo. It exhibited suppression of spermatogenesis.

AA. Hypoglycemic and Hypolipidemic Activity

Aqueous extracts of NAT flowers were used to assess hypoglycaemic and hypolipidemic properties. The aqueous extracts of the flower were given orally to adult male mice *in vivo* in a dose-dependent manner. It proved to be safe for oral consumption, which evokes promising hypoglycaemic and hypolipidemic activity. The active principle requires further investigation.

VI. SOME OTHER ACTIVITIES

Acetone extract of seeds evinced ovicidal effect on the eggs of the rice moth, Corcyra cephalonica. The inhibition of egg hatching increased with an increase in the dose of plant extracts in the contact toxicity test. 80.73% Ovicidal activity was observed at 100% concentration of the extract. The petroleum ether extract of NAT also exhibited insecticidal activity against Bagrada hirta, not Bagrada cruciferarum. The ethanolic extract of the whole plant has been reported to initiate hair growth.

A. Toxicity

The ethanolic extract of NAT leaves exhibited a toxic effect. The median fatal dose of 16 g/Kg was noticed in rats. At a dose of 2.0 g/kg, no mortality was observed; however, at a dose of 32 g/kg, 70% mortality was noted. When ethanol extracts of leaves at 1, 2, and 4 g/Kg/day were orally administered for six consecutive days, it generated gastric ulcers in rats. Additionally, this extract exhibited irritant effects, as it concentration-dependently caused the formation of unformed, semi-fluid, collagenous, pasty stools in albino mice due to a purgative effect. Rabbit developed conjunctival congestion with oedema when the extract was infused into its eye. At the same time, the person who ground the dried leaves developed vesicles on both palms.

B. Commercial Applications

The corolla tubes are used for dyeing silks and cotton. The blossoms are gathered for religious offerings and to make garlands. The essential oil in aromatic blossoms is used as perfume. The bark could be utilised as a polishing and toning material, and the leaves were used for polishing wood and ivory.

VII. CONCLUSION

NAT is perhaps a “Treasure house” of the therapeutic components! Which cures a wide range of diseases efficiently and astonishingly. This review provides information on the significance of Parijata – a divine tree in Hindu mythology, including its morphological features and phytoconstituents from different parts of the tree. The toxicity of the extracts should also be considered in human studies for safety purposes. The extracts must be administered in a dose-dependent manner. The review mainly focuses on the Therapeutic applications it possesses. NAT stands as one of the leading alternative potential medicinal plants in the treatment of various diseases. It possesses both commercial and therapeutic applications as described. However, it is disappointing that the NAT is currently listed as a critically endangered species according to the IUCN Red List. Hence, it is crucial to safeguard this excellent shrub, which possesses diverse applications. Researchers from distinct branches of the life sciences should collaborate to conduct extensive micropropagation of NAT and exploit the most essential bioactive components present in NAT, utilising advanced technologies. This research work benefits society in multiple ways, including advancements in the medical field and economic growth.

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REFERENCES:

1. Abraham A. Anti-anxiety evaluation of Nyctanthes arbour-tristis Lin. Indian Journal of Phytoconstituents, 2010; 6:77-79.
2. Aggarwal GS, Goyal S. Nyctanthes arbour-tristis Against Pathogenic Bacteria, Journal of Pharmacognosy and Phytochemistry 2013; 2 (3): 124-127.
3. Agrawal J, Pal A. Nyctanthes arbour-tristis Linn—a critical ethno pharmacological review, Journal of Ethnopharmacology 2009;146(2013)645-658. https://doi.org/10.1016/j.jep.2013.01.024
4. Aminuddin SA, Girach RD and Khan SA, Treatment of Malaria through herbal drugs from Orissa, India, Fitoterapia, LXIV (1993)545-548.
5. Badam L, Deolankar RP, Rojatkar, SR, Nagsampgi, BA and Wagh UV, In vitro antimalarial activity of medicinal plants of India, Ind J Med Res,87 (1)(1988) 19-60.
6. Balasubramanian M. Study on phytochemical screening & antibacterial activity of Nyctanthes arbour-tristis. Journal of Chemical and Pharmaceutical Research 2012; 4(3): 1686-1695.
7. Bansal G, Suri KA, Grover P. A Comprehensive Review on Nyctanthes arbour-tristis, Int. J.Drug Dev. and Res., January-March 2015,7(1):183-193.
8. Bhadouria RS, Bhargava S, Pancholi SS. Isolation and characterisation of two alkaloids from the ethanolic extract of Nyctanthes arbour-tristis leaves, Advance Research in Pharmaceutics and Biologicals, ARPB, 2012; Vol 2 (IV).
9. Bharti M, Saxena RC, Baghel OS, Saxena R, Apte KG. Wound healing activity of the leaf of Nyctanthes arbour-tristis (Linn). International Journal of Pharmaceutical Sciences and Research 2011;2: 2694-2698.
10. Bhatia A and Kaur J, Nyctanthes arbour-tristis Leaves extract as an antagonist of Immunotoxic effects of chemical pesticides (Experimental Study), Intern J Environ Studies, 58 (2001) 197-215. https://doi.org/10.1080/00207230108711327
11. Bhosale AV, Abhyankar MM, Pawar SJ, Khan S, Patil N, Nyctanthes arbor-tristis. A Pharmacognostic Review, Research J. Pharmacognosy and Phytochemistry. 2009; 1(2):91-97.
12. Biswas, I., Ukil, S., Mukherjee, A. 2014. Determination of n-alkane constituents and their phenological variation in the epicuticular wax of mature leaves of Nyctanthes arbortristis L. Nat. Prod. Res., 8(5): 330-2. https://doi.org/10.1080/14786419.2013.850689
13. Biswas1 I, Mukherjee A. Pharmacognostic Studies On The Leaf Of Nyctanthes arbour-tristis, Acta Botanica Hungarica. 2011; 53(3):225-34. https://doi.org/10.1556/ABot.53.2011.3-4.2
14. Champa Rani et al. Nyctanthes arbortristis Linn (Night Jasmine): A Sacred Ornament Plant with Immense Medicinal Potentials. Indian Journal of Traditional Knowledge. 2012; 11(3):427-35.
15. Chatterjee SK, Bhattacharjee I & Chandra G, Bactericidal

ActivitiesofSomeCommon HerbsinIndia, PharmaceuticalBiol, 2007; 45(5): 350-354. https://doi.org/10.1080/13880200701212940
16. Das S, Sasmal D, Basu SP. Evaluation of CNS Depressant Activity of Different Plant Parts of Nyctanthes arbortristis Linn. Indian Journal of Pharmaceutical Sciences 2008; 70(6): 803-806. https://doi.org/10.4103/0250-474X.49129
17. Desai SV, Dhumal AS, Chauhan PS. Literature review on Nyctanthes arbour-tristis, International Journal of Pharmacy and Technology, 2016, Vol-I, Issue No. 1, 3611-3628.
18. Deshmukh RD. Amelioration of CCl4-Induced Hepatosuppression by Nyctanthes arbour-tristis Linn Leaves in Wistar Albino Rats. Journal of Pharmacology Online, 2007; 1: 203-208.
19. Devasagayam TPA & Sainis KB, Immune system and antioxidants, especially those derived from Indian medicinal plants, Indian J ExpBiol, 2002; 40: 639-655.
20. Dhingra VK, Seshadri TR, Mukerjee SK. Carotenoid glycosides of Nyctanthes arbour-tristis Linn., Ind J Chem 1976; 14B;231.
21. Gadgoli, C., Shelke, S. 2010. Crocetin from the tubular calyx of Nyctanthes arbortristis. Nat. Prod. Res., 24(17): 1610 5. https://doi.org/10.1080/14786411003754363
22. Geetha DH, Jayashree I, Rajeswari M. Antibacterial activity of the leaf of Nyctanthes arbour-tristis Linn. International Research Journal of Pharmaceutical and Applied Sciences 2014; 4(4): 4-6.
23. Ghosh, K., Ray, S., Bera, K., Ray, B. 2015. Isolation and structural elements of a water-soluble free radical scavenger from Nyctanthes arbortristis leaves. Phytochem., 115: 20-6. https://doi.org/10.1016/j.phytochem.2015.02.007
24. Goyal DK, Tiwari SK, Agarwal R. Effect of Parijat leaves on sciatica. Sachitra Ayurved 1999; 51: 667-668.
25. Gupta RS, Kachhawa JBS, Sharma R. Antispermatogenic effects of Nyctanthes arbour-tristis in male albino rats. Physiology 2006;261–73.
26. Hirapure P, Pote M. Antimicrobial activity of Nyctanthes arbortristis Linn on a few clinical isolates. International Journal of Pharmaceutical Research and Bioscience 2014; 3(2): 80-85
27. Hukkeri V, Akki K, Sureban RR, Gopalkrishnan B, Byahatti VV, Rajendra SV. “Hepatoprotective activity of the leaves of Nyctanthes arbour-tristis Linn”. Indian Journal of Pharmaceutical Sciences 2006; 4:542-543. https://doi.org/10.4103/0250-474X.27844
28. Jain PK, Pandey A. The wonder of Ayurvedic medicine- Nyctanthes arbour-tristis. International Journal of Herbal Medicine, 2016, 4(4): 9-17.
29. Jain PK. Alternative herbal remedies are used to treat hair diseases. Asian J Pharm Clin Res. 2016; 9(1):75-7. 53. Jain PK, Dass DJ. Evaluating the hair growth potential of some traditional herbs. Asian J Pharm Clin Res. 2015; 8(6):150-2. 54.
30. Jain R, Mittal M. A review on pharmacological and chemical documentation of N. arbour-tristis Linn. Asian Journal of Traditional Medicine, 2011; 6(5): 187-2023.
31. Jain, Pushpendra Kumar. Ethanopharmacological Study of Cyperus Rotundus-A Herb Used By Tribal Community as a Traditional Medicine for Treating Various Diseases. Innovare Journal of Ayurvedic Sciences. 2016; 4(2):4-6. 55.
32. Kapoor LD et al. Survey of Indian plants for saponins, alkaloids, and flavonoids, II. Lloydia. 1971;34:94.
33. Karnik SR, Tathed PS, Antarkar DS, Gidse CS, Vaidya RA. Antimalarial activity and clinical safety of traditionally used Nyctanthes arbour-tristis Linn. Indian Journal of Traditional Knowledge 2008; 7: 330–334.
34. Khandelwal KR, Kadam SS & Singhama, Antibacterial activity oftheleavesofNyctanthesarbor-tristisLinn., Indian J Nat Prod, 1999; 15: 18-20.
35. Khatu na, haue me, mosaddik ma. Laboratory evaluation of Nyctanthes arbour-tristis Linn. Flower extract and its isolated compound against the common filarial vector, Culex quinquefasciatus Say (Diptera: Culicidae) larvae. Pak. J Bio Sci. 2001; 4(5):585-87 https://doi.org/10.3923/pjbs.2001.585.587
36. Khatune NA, Islam ME, Abdur Rahman MA, Mosaddik MA, Haque ME. In vivo cytotoxic evaluation of a new benzofuran derivative isolated from N. arbortristis L. on Ehrlich ascites carcinoma cells in mice. J Med Sci 2003; 3(2): 169-173. https://doi.org/10.3923/jms.2003.169.173
37. Khatune NA, Mosaddik MA . Antibacterial activity and cytotoxicity of Nyctanthes arbour-tristis flowers, Fitoterapia 72 2001 412-414. https://doi.org/10.1016/S0367-326X(00)00318-X
38. Kiew R, Baas P. Nyctanthes is a member of Oleaceae. Proc Indian Acad Sci. 1984; 3:349-58. https://doi.org/10.1007/BF03053088
39. Kirtikar KR, Basu BD. In: Indian Medicinal Plants. Sri Satguru (Ed.), Allahabad, 1993, pp. 1526-1528.
40. Kirtikar KR, Basu BD. Indian Medicinal Plants. Vol.VII, Sri Sat Guru Publications, New Delhi, 2000: pp. 2110-2113
41. Kirtikar KR, Basu BD. Nyctanthes arbour-tristis in medicinal plants, edited by Blatter E, Cains JF, Mhaskar KS, (LM Basu Publishers, Allahabad, India), 1935, 536.
42. Kumari S TD. Antioxidant and Anticancer Activities of Nyctanthes arbour-tristis, International Journal of Pharmacy and Pharmaceutical Sciences. 2012; 4(4):212-15.
43. Laghate P, Grampurohit ND, Miranda S. Antihepatotoxic activity of the leaves of Nyctanthes arbortristis L., In: Nyctanthes arbortristisional Convention on current Herbal Drugs and Annual Conference of Indian Society of Pharmacognosy; Herb: The Nyctanthes arbortristisural alter Nyctanthes arbortristisive, Gandhinagar, 2003
44. Lucas DS, Sekhar RAR. A review of experimental studies on antihepatoprotective activity of certain medicinal plants used in Ayurveda, Phytomedicine, Supplement-II 2000, 23.
45. Mahida Y, Mohan JSS. Screening of plants for their potential antibacterial activity against Staphylococcus and Salmonella sp. Natural Product Radiance. 2007; 6:301-05.
46. Meshram MM, Rangari SB, Kshirsagar SB, Gajbiye S, Trivedi MR, Sahane RS. Nyctanthes arbour-tristis - A herbal panacea. International Journal of Pharmaceutical Sciences and Research 2012; 3(8): 2432-2440.
47. Mishra, P.D., Verekar, S.A., Deshmukh, S.K., Joshi, K.S., Fiebig, H.H., Kelter, G. 2015. Altersolanol A: a selective cytotoxic anthraquinone from a Phomopsis sp. Lett. Appl. Microbiol., 60(4): 387-91. https://doi.org/10.1111/lam.12384
48. Misra P, Pal NL, Guru PY, Katiyar JC, Tandon JS. Antimalarial activity of traditional plants against erythrocytic stages of Plasmodium berghei. Int. J. Pharmacogn. 1991;29(1):19–23. https://doi.org/10.3109/13880209109082843
49. Nadkarni KM. Indian Materia Medica. 3rd ed. Vol. I, Bombay Popular Prakashan Pvt. Ltd., Bombay, 1982, pp. 115-116.
50. Narendhirakannan RT, Smeera T. In-vitro antioxidant studies on ethanolic extracts of leaves and stems of Nyctanthes arbour-tristis L. (Night-flowering jasmine). International Journal of Biology and Medical Research 2010; 1: 188- 192.
51. Nawaz AHMM, Hossain M, Karim M, Khan M, Jahan R, Rahmatullah M. An ethnobotanical survey of Jessore district in Khulna Division, Bangladesh. American Eurasian Journal of Sustainable Agriculture, 2009; 3: 238-243.
52. Naznin AK, Ashik MM and Haque ME. Antibacterial activity and cytotoxicity of Nyctanthes arbortristis flower. Fitoterapia 2001; 72: 412-414. https://doi.org/10.1016/S0367-326X(00)00318-X
53. Nirmal SA, Pal SC, Mandal SC, Pharmacognostic evaluation of Nyctanthes arbortristis bark, Asian Pacific Journal of Tropical Biomedicine (2012)S494-S500. https://doi.org/10.1016/S2221-1691(12)60260-3
54. Omkar A, Jeeja T, Chaaya G. Evaluation of anti-inflammatory activity of Nyctanthes arbour-tristis and Onosma echioides. Pharmacognosy Magazine 2006; 258-260.
55. Pattanayak C, Datta PP, Chauhan AS, Firdoush KA, Prasad A, Panda P. Hypoglycaemic effect of Nyctanthes arbour-tristis leaf extract on alloxan induced diabetic rats. American Journal of PharmTech Research 2012; 2(6): 380-387.
56. Paul BN, Saxena AK. Depletion of tumour necrosis factor-α in mice by N. arbour-tristis. Journal of Ethnopharmacology,1997;56:153-158. https://doi.org/10.1016/S0378-8741(97)01525-0
57. Prasad MP, Shekhar S. In Vitro Phytochemical and Antimicrobial Activity of Nyctanthes arbour-tristis Linn against Human Pathogens. International Journal of Pure & Applied Bioscience 2014; 2 (1): 1-5.
58. Puri A, Saxena R, Saxena KC, Tomdon JS and Srivastava V. Immunomostimulant activity of Nyctanthes arbour-tristis L., J Ethnopharmacology,42 (1994) 31-37. https://doi.org/10.1016/0378-8741(94)90020-5
59. Puri A, Saxena RP, Saxena R, Saxena KC, Tandon JS, Srivastava V (1994) Immunostimulant activity of Nyctanthus arbour-tristis L. Ethnopharmacolgy 42(1): 31-37. https://doi.org/10.1016/0378-8741(94)90020-5
60. Pushpendra Kumar Jain, Debajyoti Das, Puneet Jain. Evaluating Hair Growth Activity of Herbal Hair Oil. Int J Pharm Tech Res. 2016; 9(3):321-27.

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