

Harshringar (*Nyctanthes arbour-tristis*): Phytochemistry, pharmacological and therapeutic potential

Kriti Shah, Ravi Kant Upadhyay

Department of Zoology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, Uttar Pradesh, India

Abstract

This review article presents phytochemistry, pharmacological and therapeutic potential of *Nyctanthes arbour-tristis*. In this review, various biological activities, particularly, that is, anti-protozoic, anti-microbial, anti-viral, anti-cancer, anti-inflammatory, histamine-mediated activities, anti-oxidant, anti-diabetic, hepatoprotective, anti-rheumatoid arthritis, insecticidal, immunomodulatory, wound healing and sedative. The plant contains important bioactive constituents, including iridoid glycosides, flavonoids, alkaloids, tannins, and sterols, which contribute to its therapeutic effects. The plant exhibits promising anti-cancer activity by inducing apoptosis, inhibiting cellular proliferation, and reducing oxidative stress, with compounds such as arbortristoside A, calceolarioside A, and β -sitosterol showing notable cytotoxic potential. This plant has wider therapeutic applications and is used in traditional medicine by local people for cold, cough and fever. Its hot water concoction is used for pain relief and gastrointestinal problems. No doubt, the Harshringar plant is a big depository of natural products which could be used for drug development. It is suggested that further clinical studies are required to establish its safety, efficacy and therapeutic applicability.

Key words: Harshringar, *Nyctanthes arbour-tristis*, pharmacological, therapeutic potential

INTRODUCTION

N*yctanthes arbour-tristis* Linn. (family: Oleaceae), widely recognized as night-flowering jasmine, Parijat, or Harsingar (Family: Oleaceae), holds an important role in traditional medicinal practices in the Indian subcontinent and various parts of Asia.^[1,2] In various regions of India, the plant is referred to by different names; it is called sephalika in Sanskrit, pavalamallikai in Tamil, parijata, pavizhamalli, and siharu in South Indian states. The state flower of West Bengal is *N. arbour-tristis*. In West Bengal, the goddess is worshipped during Navratri Durga Pooja. *N. arbour-tristis* is a small tree that reaches heights of up to 25 feet and has peeling grey bark. The leaves are arranged oppositely, simple, measuring 6–12 cm (2.4–4.7 in) in length and 2–6.5 cm (0.79–2.56 in) in width, featuring a smooth margin. The blooms are aromatic, featuring a white corolla that has five to eight lobes and an orange-red center [Figure 1]. The fruit is a flat, bilobed, brown capsule that is heart-shaped to round, measuring 2 cm (0.79 in) in diameter, with each lobe housing one seed. An orange pigment derived from the corolla,

nyctanthin, is utilized to color silk. In India, garlands are crafted from flowers and used in religious ceremonies.

This Ayurvedic herb is well known for its ability to heal fevers like dengue and malaria, sciatica, joint discomfort, and arthritis. Its leaves, blossoms, and seeds are used to treat bacterial infections, inflammation, and infections, especially digestive and respiratory conditions. It has been used medicinally since the beginning of human civilization and is described in Indian Ayurvedic scriptures. The plant's leaves, seeds, flowers, roots, and bark have all been widely used for centuries in folk and traditional medicine to treat a variety of ailments, including fever, sciatica, arthritis, gynecological disorders, liver problems, parasitic infections, dermatological diseases, and bilious conditions. This plant is still used in many different groups, which highlights its supposed therapeutic value and calls for a thorough scientific investigation.^[3]

Address for correspondence:

Ravi Kant Upadhyay, Department of Zoology, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur, Uttar Pradesh, India. E-mail: rkupadhya@yahoo.com

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Figure 1: Harshringar plant and its aerial parts

PHYTOCHEMISTRY

N. arbor-tristis possesses a rich and diverse chemical profile, comprising steroids, terpenoids, flavonoids, phenolic compounds, iridoid glycosides, alkaloids, and other lipophilic and volatile constituents [Table 1 and Figure 2]. These secondary metabolites are unevenly distributed across different plant parts and are responsible for a broad spectrum of pharmacological activities.^[4] Experimental and clinical studies have demonstrated anti-inflammatory, antioxidant, analgesic, antidiabetic, anti-arthritis, cytotoxic, antimicrobial, antimalarial, anthelmintic, larvicidal, bronchodilatory, hepatoprotective, immunomodulatory, neuroprotective, and wound-healing properties. *N. arbor-tristis* as a promising source of natural therapeutic agents.^[5] Harshringar is traditionally used in arthritis, sciatica, and other inflammatory disorders.^[6] Its bioactive constituents do cytokine modulation, immunosuppressive, and play immunoregulatory roles.^[7]

THERAPEUTIC USES

The plant also exhibits noteworthy antimalarial and antiparasitic activities. Extracts from *N. arbor-tristis* shown the potential to reduce fever, normalize inflammatory cytokines, and eliminate parasites, including *Plasmodium* species. It demonstrates parasite death caused by oxidative stress, which is mostly ascribed to iridoid glycosides and lipid-associated components. Glycosides, flavonoids, and phenolic compounds are among the highly active bio-organic substances found in *N. arbor-tristis* that have significant medicinal significance. *N. arbor-tristis* affects important biological pathways and is very helpful in the treatment of inflammation. In addition, the plant exhibits medicinal potential, is employed in the production of natural drugs, and has traditional ethnopharmacological claims.^[8-10] In modern medicine, it is quite helpful for healthcare.^[11]

SOURCE OF INFORMATION

A comprehensive literature review on the Harshringar plant (*N. arbor-tristis*) was conducted using databases such as Medline, SCOPUS, Web of Science, EMBASE, PubMed,

Swiss-Prot, and Google Scholar for studies published up to 202\6. Relevant information was retrieved using MeSH terms and keywords related to its therapeutic uses. Abstracts and full-text articles were screened, and additional references were identified from cited studies. Various sources, including research articles, books, and conference reports, were included. The collected data were then systematically analyzed and summarized.

PHARMACOLOGICAL ACTIVITIES

Natural products from *N. arbor-tristis* continue to be a key component of contemporary drug discovery, offering structurally varied and physiologically powerful lead molecules for the creation of innovative treatments with increased effectiveness and few side effects. In particular, medicinal plants continue to be a priceless source of bioactive compounds that have historically influenced the development of a number of modern medications. This is among the significant ethnopharmacologically noteworthy plants.

Antiprotozoal

N. arbor-tristis by testing extracts from different plant parts showed larvicidal activity against mosquito species like *Aedes aegypti*, *Anopheles stephensi*, and *Culex quinquefasciatus*.^[12] It can be used to develop eco-friendly, plant-based larvicidal agents for sustainable vector control.^[13]

Antimicrobial

N. arbor-tristis by testing extracts and essential oils from various plant parts was found active against pathogenic bacteria and fungi.^[14] Antimicrobial activity is supported by very low minimum inhibitory concentration and minimum bactericidal concentration/minimum fungicidal concentration values.^[15] *N. arbor-tristis* shows toxicity in *Artemia salina*.^[17] It also found effective against antimicrobial-resistant strains.^[17] This plant contains active antimicrobial compounds, including terpenoids, iridoid glycosides, sterols, and flavonoids.^[18]

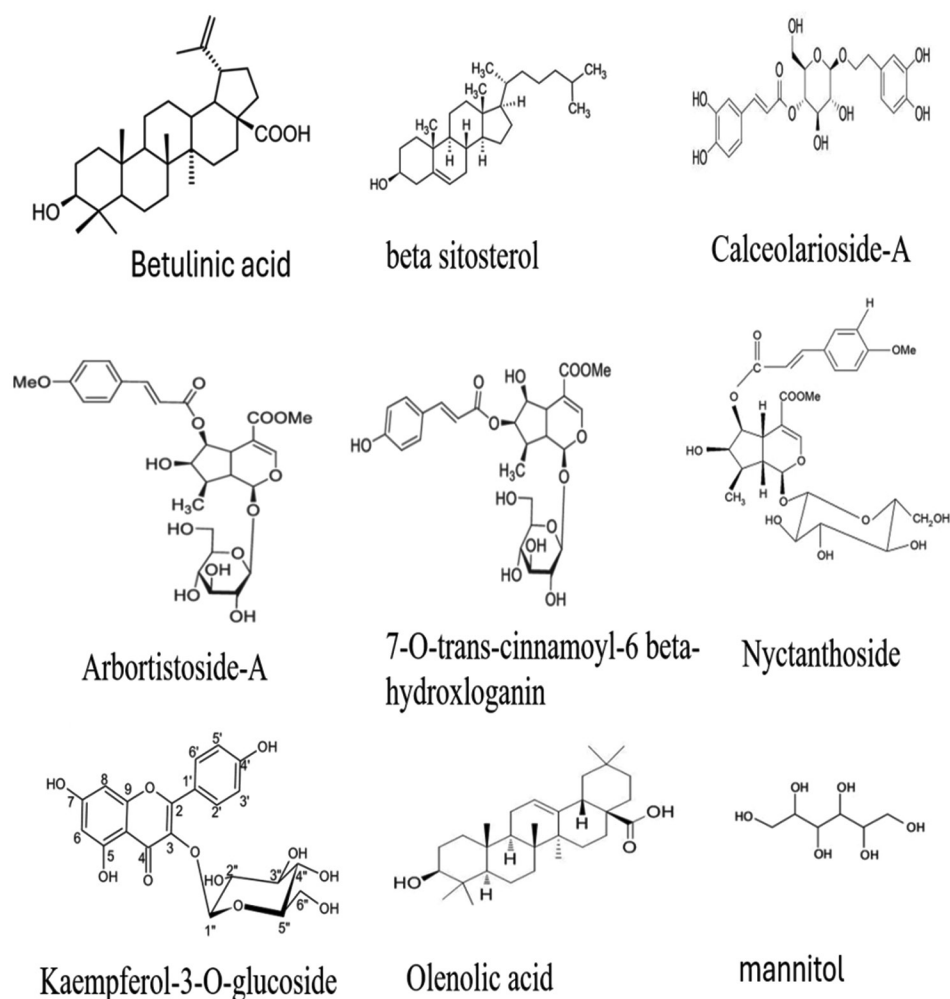


Figure 2: Structure of bioactive compound in *Nyctanthes arbor-tristis*

Antiviral Activity

Because of its abundance of bioactive volatile chemicals like terpenoids and phenolic substances, the essential oil of *N. arbor-tristis*, often known as night flowering jasmine, has shown encouraging antiviral potential.^[19] It is known that these phytochemicals prevent viruses from replicating, prevent them from entering host cells, and lessen oxidative stress caused by viruses. By minimizing tissue damage through host inflammatory response modulation and viral proliferation suppression, the oil demonstrates notable effectiveness against specific viral strains. Its relevance as a possible antiviral treatment option is further increased by its natural origin and relatively low cytotoxicity against normal cells.

Anti-inflammatory Activity

N. arbor-tristis Linn. essential oils obtained from different plant parts, anti-inflammation activity.^[20] Oil components suppressed pro-inflammatory mediators.^[21] The key anti-inflammatory component is iridoid glycosides (including

arbotristosides), terpenoids, sterols, flavonoids, and phenolic compounds.^[22] Plant is also used for traditional anti-inflammatory treatment and is suitable for further drug development.

Histamine and Anti-Cancer Activity

By preventing histamine-induced edema and lowering inflammation in experimental models, *N. arbor-tristis* exhibits notable anti-inflammatory properties. It works by lowering vascular permeability, decreasing edema, and regulating histamine-mediated pathways. It also controls important inflammatory mediators by increasing anti-inflammatory cytokines like Interleukin (IL-10) and decreasing proinflammatory cytokines like tumor necrosis factor-alpha (TNF- α) and cyclooxygenase-2 (COX-2). Its traditional usage in treating inflammatory diseases is supported by these combined actions, which emphasize its position as a strong natural anti-inflammatory agent.^[23] The plant has a variety of bioactive substances, including sterols, flavonoids, alkaloids, tannins, and iridoid glycosides (arbotristosides A, B, and C). They have significant anti-cancer potential.^[24] Its capacity to

prevent cell division, trigger apoptosis, and lessen oxidative stress through antioxidant pathways is primarily responsible for this. *N. arbor-tristis* phytoconstituents target cell cycle progression and are useful in anticancer drug development.^[25]

Anti-Oxidant Activity

N. arbor-tristis demonstrates significant anti-inflammatory properties by reducing histamine-induced edema and inflammation in experimental models [Figure 3]. It lowers vascular permeability, decreases oedema, and modulates histamine-related pathways, while increasing anti-inflammatory cytokines like IL-10 and decreasing pro-inflammatory ones like TNF- α and COX-2.^[26] This supports its traditional use for inflammatory diseases. The plant contains bioactive substances such as sterols, flavonoids, alkaloids, tannins, and iridoid glycosides, which exhibit strong anti-cancer potential through mechanisms like inhibiting cell division, promoting apoptosis, and reducing oxidative stress.^[27]

Anti-Diabetic Activity

N. arbor-tristis Linn. phytochemical constituents responsible shows glucose-lowering effects. Along with an assessment of their toxicity and safety profiles, extracts and essential oils obtained from different plant parts, including leaves, flowers, seeds, stem bark, and roots, are evaluated using established *in vitro* and *in vivo* models relevant to diabetes mellitus. Anti-diabetic activity is due to inhibition of carbohydrate-hydrolyzing enzymes (α -amylase and α -glucosidase), thus

is confirmed *in vivo* using experimental animal models in streptozotocin- or alloxan-induced diabetic models.^[28] The anti-diabetic activity is due to the presence of flavonoids, phenolic compounds, iridoid glycosides, terpenoids, and lipid associated constituents. These components also modulate glucose metabolism and insulin sensitivity.^[29]

Hepatoprotective Activity

N. arbor-tristis leaf extracts (aqueous and alcoholic) exhibit significant hepatoprotective activity against carbon tetrachloride-induced liver damage in rats at a dose of 500 mg/kg body weight [Figure 3]. The treatment effectively lowers elevated liver enzymes such as serum glutamic pyruvic transaminase and serum glutamic-oxaloacetic transaminase, along with serum bilirubin levels, indicating improved liver function.^[30] Histopathological studies further confirm the regeneration of hepatocytes, demonstrating restoration of liver tissue.^[31] The hepatoprotective effect is mainly attributed to the presence of bioactive compounds such as flavonoids, iridoid glycosides (arbortristoside A and B), triterpenoids, phenolic compounds, and β -sitosterol. These constituents act primarily through antioxidant and free radical scavenging mechanisms, thereby protecting liver cells from toxin-induced oxidative damage.^[33]

Anti-Rheumatoid Arthritis Activity

N. arbor-tristis (Harsingar) shows strong anti-rheumatoid arthritis activity, as supported by experimental and molecular studies.^[34] Leaf extracts, especially hydroethanolic ones,

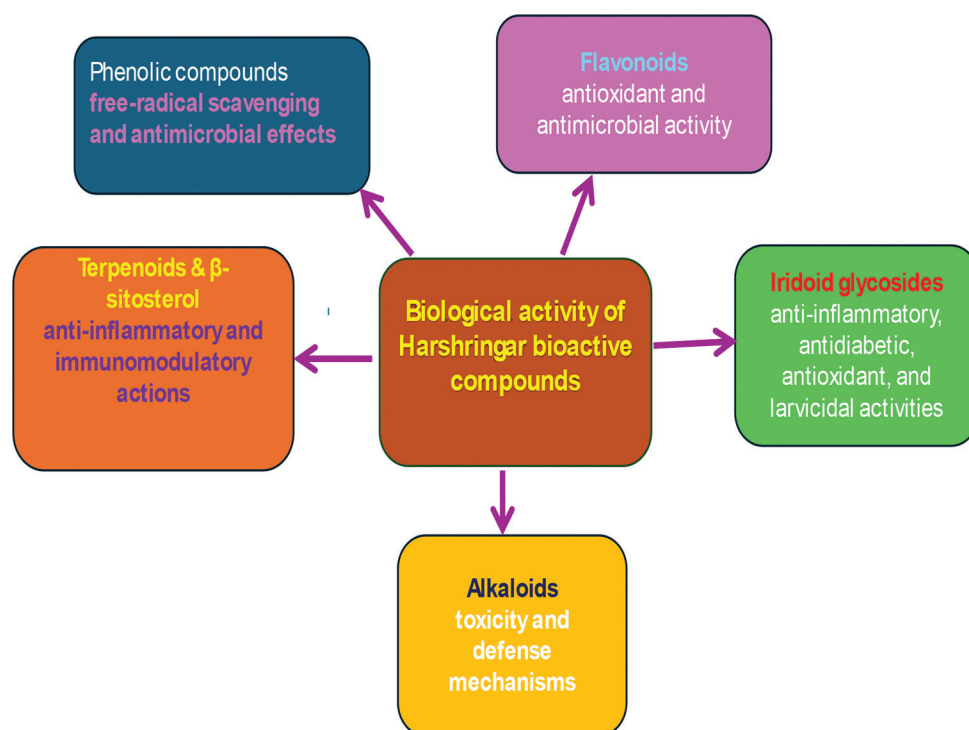


Figure 3: Biological activity of haringar (*Nyctanthes arbor-tristis*) bioactive compounds

Table 1: Major components of various plant parts of the Harsingar plant and their biological activity

Bioactive compounds	Major components	Plant parts	Biological activity
Iridoid glycosides	Arborside A Arborside C Arborside F Nyctanthoside Loganin 6,7-di-O-benzonylnyctanthoside	Leaves and flowers	Anti-inflammatory Anti-malarial Antioxidant Anti-ulcer Anticancer
Terpenoids and triterpenes	Betulinic acid; Terpenoids	Leaves	Analgesic Anti-inflammatory
Sterols	Beta-sitosterol	Leaves	Antifungal Anti-inflammatory Dermatological uses
Flavonoids and phenolic compounds	Kaempferol-3-O-glucoside. Kaempferol-3-O-rutinoside; Calceolarioside A; Phenolic compounds	Flower and seeds	Antioxidant Anti-inflammatory Anti-leishmanial antifungal
Alkaloids Saponins Tannins	Nyctanthine Arbortristoside A, B, C, D, and E tannic acid	Stem	Antioxidant Antimicrobial Wound healing

significantly reduce joint swelling, inflammation, and arthritic symptoms in animal models. The components of *Nyctanthes arbor-tristis* Linn. did lowering of pro-inflammatory markers such as TNF- α and COX-2 but increase anti-inflammatory cytokines like IL-10, that help in regulating the immune responses. It also improves blood and biochemical parameters and protects joint tissues by reducing synovial thickening and damage. Moreover, its bioactive compounds demonstrate a strong ability to inhibit Janus kinases, indicating a mechanism similar to modern anti-arthritis drugs [Figure 3].^[35]

Anti-Insecticidal

N. arbor-tristis (Harsingar/Parijat) exhibits notable anti-insecticidal properties.^[41] Extracts from its leaves, seeds, and flowers have shown effectiveness against various insect pests and larvae by disrupting their growth, feeding behavior, and survival. The mechanism primarily involves interference with the insect nervous system, inhibition of metabolic enzymes, and damage to cellular membranes, leading to mortality or reduced reproduction. Extracts also work as repellent agents, particularly against disease vectors and agricultural pests.^[37] It can be used in the development of eco-friendly, biodegradable alternative to synthetic insecticides, [Figure 3].

Immunomodulatory

Studies on *N. arbor-tristis* highlight its significant immunomodulatory and anti-inflammatory potential.^[38] The crucial role of leukotrienes in airway inflammation, providing a basis for exploring plant-based modulators. This demonstrated the immunostimulant activity of *N. arbor-tristis*, indicating its ability to enhance immune responses.^[40] Further reported cytokine induction and increased splenocyte

proliferation on treatment with its extracts, confirming its role in immune activation.^[41] Together, these studies suggest that *N. arbor-tristis* possesses promising bioactive compounds that can modulate immune function and inflammation, supporting its potential therapeutic applications.^[42]

Wound Healing Activity

N. arbor-tristis leaves exhibit significant wound healing activity, as demonstrated in animal models through enhanced wound contraction, faster epithelization, and improved collagen formation.^[41] Methanolic and ethanolic extracts promote angiogenesis and increase hydroxyproline content, aiding tissue regeneration. Its compounds collectively accelerate tissue repair and protect the wound from infection, supporting its traditional medicinal use.^[42]

Sedative Activity

N. arbor-tristis exhibits significant sedative activity, with ethanolic leaf extracts showing stronger central nervous system depressant effects than methanolic extracts, as evidenced by increased sleeping time and reduced locomotor activity.^[43] This sedative property is mainly attributed due to iridoid glycosides (e.g., arbortristosides), flavonoids, and alkaloids, which may modulate neurotransmitter activity.^[44] Plant is also traditionally used as a calming and sleep-inducing agent.^[45]

CONCLUSION

N. arbor-tristis Linn. (family: Oleaceae), commonly known as night-flowering jasmine, Parijat, or Harshringar, occupies

a prominent position in traditional medicinal systems of the Indian subcontinent and other regions of Asia. Plant has potential bioactivity leaves, seeds, flowers, roots, and bark. This is extensively used in folk and traditional medicine for the treatment of antibilious conditions, fever, arthritis, sciatica, gynecological disorders, liver ailments, parasitic infections, and dermatological diseases. The continued use of this plant across diverse communities underscores its perceived therapeutic value and warrants systematic scientific evaluation. Its Natural products continue may serve as templates for modern drug discovery. This is only possible after providing structurally diverse and biologically potent lead compounds for the development of novel therapeutics. *N. arbor-tristis* possesses a rich and diverse chemical profile, comprising steroids, terpenoids, flavonoids, phenolic compounds, iridoid glycosides, alkaloids, and other lipophilic and volatile constituents. These secondary metabolites are unevenly distributed across different plant parts and are responsible for a broad spectrum of pharmacological activities. Plant demonstrates anti-inflammatory, antioxidant, analgesic, antidiabetic, anti-arthritic, cytotoxic, antimicrobial, antimalarial, anthelmintic, larvicidal, bronchodilatory, hepatoprotective, immunomodulatory, neuroprotective, and wound-healing properties. Collectively, these findings highlight *N. arbor-tristis* as a promising source of natural therapeutic agents.

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