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# Phytochemicals and Pharmacological Properties of *Nyctanthes arbor-tristis*: A Review

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## ABSTRACT:

*Nyctanthes arbor-tristis* (L.) is a member of family Oleaceae. The present review was based on the phytochemicals and pharmacological properties of *Nyctanthes arbor-tristis*. It is a large shrub with erect growth habit upto 10m in height. The bark on the branches is a flaky greyish green and the branches themselves are square. Broadly oval or rhomboid in shape, with a sharp apex and an entire border, the leaves are simple, exstipulate, opposite, and unifoliate. It is 10 cm in length and 5 cm in width and may be any shade of green from pale to dark. The leaves contain D-mannitol,  $\beta$  sitosterol, flavanol glycosides, astragalin, nicotiflorin, oleanolic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, an amorphous glycoside, an amorphous resin, friedeline, trace of volatile oil, carotene, lupeol, glucose, iridoid glycosides, mannitol, fructose, and benzoic acid. It has been used traditionally in inflammations, dyspepsia, flatulence, colic, ophthalmopathy, splenomegaly, greyness of hair and baldness. It concluded that *Nyctanthes arbor-tristis* is rich source of numerous phytoconstituents and used traditionally in the management of various ailments. It has been reported for pharmacologically activities in various diseases i.e., anti-diabetic, anti-malarial, antioxidant, anticancer, anti-inflammatory and analgesic, antimalarial, antiparasitic, and anti-aggressive.

**Keywords:** *Nyctanthes arbor-tristis*, phytoconstituents, traditional uses, biological properties, antioxidant.



## INTRODUCTION

The extensive investigation and broad popularity of *Nyctanthes arbor-tristis* Linn. It is known by several colloquial names in various languages and regions [1]. From its birthplace in India, it has expanded throughout the Sub-Himalayan region and gained popularity as an ornamental plant in Indian gardens [2]. *Nyctanthes arbor-tristis* (NA) has long been used by Native Americans as a medicine to treat a variety of ailments. Due to its many medicinal uses, the plant is a mainstay in the traditional Ayurvedic, Siddha, and Unani systems of medicine [3][4]. The leaves can be used to alleviate depression. The root can be used to cure fever, sciatica, and anorexia; the bark can be used as an expectorant; and the leaf has multiple uses, including cholagogue, diaphoretic, and anthelmintic. The liquid extract obtained from the bark's decoction is used to treat malaria and arthritis [5]. According to reports, leaf extract from NA possesses laxative, antihistamine, and tranquilizing properties [6]. Polysaccharides, phenylpropanoid  $\beta$ -sitosterol, iridoid glycosides, glycoside,  $\beta$ -amyrin, glycosides, hentriacontane, nyctanthoside, benzoic acid, iridoid glucoside, nyctanthic acid, friedelin, lupeol, oleanolic acid, 6 $\beta$ -hydroxylonganin, alkaloids, tannins, terpenoids, glycosides, and arbortristoside A, B, and C have been isolated from this plant, according to earlier studies [7-9]. Its important biological properties, such as those against diabetes [10], allergies [11], antioxidants [12], and inflammation [13], were discovered after a thorough pharmacological evaluation. It thrives in loamy soils with a pH of 5.6 to 7.5. The climatic need runs from broad sunlight to moderate shade. Watering should occur every day, but not to the point of overwatering [14].

## Taxonomy

Kingdom: Plantae

Division: Angiosperms

Class: Dicotyledonae

Sub class: Gamopetalae

Series: Bicarpellatae

Order: Gentiales

Family: Oleaceae

Genus: *Nyctanthes*

Species: *arbor-tristis*

## Botanical Description

*Nyctanthes arbor-tristis* (L.) is Angiospermic seed bearing flowering plant. It is a member of family Oleaceae. The word *Nyctanthes* comes from Greek word “nukto–ankoj” which means night flower and the species *arbor-tristis* means melancholy or sorrow full tree. It is known by various vernacular names such as night flowering jasmine; coral jasmine; tree of sadness.<sup>112</sup> It

is often cultivated for its fragrance. It is commonly cultivated in the plains of central India and often found in dry deciduous forest [15]. It is reported southwards to Godavari and naturalize in several place in foot hills of temperate Himalayan region and Sub-Himalayan tract. It can be cultivated from sea-level up to 1500 m altitude. It is a large shrub with erect growth habit upto 10m in height. The bark on the branches is a flaky greyish green and the branches themselves are square. Broadly oval or rhomboid in shape, with a sharp apex and an entire border, the leaves are simple, exstipulate, opposite, and unifoliate. It is 10 cm in length and 5 cm in width and may be any shade of green from pale to dark. Trichotomous cymes with a terminal flower are the inflorescence. Positioned axillarily, it may be found in the cluster at the tips of the branches. Typically, September through November was blossoming time. The blossom is yellow because it contains saffron. The blooms' cylindrical tubes are orange and rather huge. The flower tubes are white on the inside and out, and they are radially symmetrical around a bright orange core. The calyx tube is just 3–4 mm in length and has very fine teeth. The corolla is white with five to eight orange-red lobes. The tubes that form the corollas are typically cylindrical and range in length from 8 to 14 millimeters. Both the corolla tube and the base of the petals have two stamens inserted into them. Short filaments and two-celled, extrose anthers are typical. A syncarpous ovary with two ovules per cell. The writing style is often brief, straightforward, and stigma terminal simple or bilobed. The months of December through March were typically fruitful. The fruit has a single seed and ranges in form from flat brown heart to circular capsule. The capsule is crushed into an orb shape and is chartaceous in appearance. Fruits are typically 2 centimeters in diameter, green when unripe but a light brown when ripe [16].



**a. Leaves + flowers**



**b. Whole plant**

**Fig 1. Different parts of *Nyctanthes arbortristis***



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### **Vernacular Names [17]**

English: Night jasmine

Kannada:Parijatha

Telugu:Pagadamalle

Marathi:Parijathak

Gujrati:Jayaparvati

Malayalam:Parijatakam

Sanskrit:Parijatha

Bengali:Sephalika

Hindi:Harsingar

Oriya:Gangasiuli

### **Ecology and Distribution**

The *N. arbor* prefers a somewhat shaded setting. It is grown all throughout the tropics and subtropics of the planet. *N. arbor* is a species that originated in dry deciduous forests on rocky hilltops. The northern regions of Pakistan and Nepal, together with northern India and southeast Thailand, are all within its native range. The eastern border of Nepal with Assam, eastern Assam, Bengal, and Tripura, the middle area of the nation up to the Godavari River in the south, and the outer Himalayas are all places where you may find this species in India [18]. It grows well in loamy soils having pH 5.6 to 7.5. Climatic requirement is from full sunlight to partial shade. Daily watering is required but overwatering is not the case [19].

### **Phytochemistry**

As per phytochemical analysis, *N. arbor* possesses Phenolics, flavonoids, glycosides, carbohydrates, alkaloids, phytosterols, tannins and saponins.<sup>109</sup> Among all, glycosides and alkaloids are largely produced phytochemicals. This plant is known for its iridoids and secoiridoids compounds as it possesses pharmacological activities such as anti-inflammatory, anti-cancer, anti-diabetic, immunosuppressive, neuroprotective and anti-obesity [20]. Leaves of *N. arbor* contain mannitol, iridoid glucosides (A, B, C and D), Calceolarioside,  $\beta$ -sitosterol, triterpenoids, vitamin C, carotenoids etc. Stem bark of this plant possess glycosides,  $\beta$ -sitosterol and alkaloids. Flowers have accommodated essential oil, nyctanthin, arboriside C, nyctoside, ester of  $\alpha$ -crocetin, sugars and carotenoids. Seeds of the plant contain Arboristoside A, B, C, D and E, water soluble polysaccharides, nyctoside A etc. These all phytoconstituents are pharmacologically active compounds involved in some or other bioactivities [21].

## Reported Phytoconstituents [22]

### Leaves

The leaves contain D-mannitol,  $\beta$  sitosterol, flavanol glycosides, astragalín, nicotiflorin, oleanolic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, an amorphous glycoside, an amorphous resin, friedeline, trace of volatile oil, carotene, lupeol, glucose, iridoid glycosides, mannitol, fructose, and benzoic acid.

### Flower

Glycosides such as -monogentiobioside ester of -crocetin (or crocin-3), -monogentiobioside--D monoglucoside ester of -crocetin, and -digentiobioside ester of -crocetin (or crocin-1) are found in the flowers.

### Bark

The bark comprises alkaloids and glycosides.

### Seeds

Arbortristoside A&B, Glycerides of linoleic oleic, lignoceric, stearic, palmitic and myristic acids, nyctanthic acid, 3-4 secotriterpene acid.

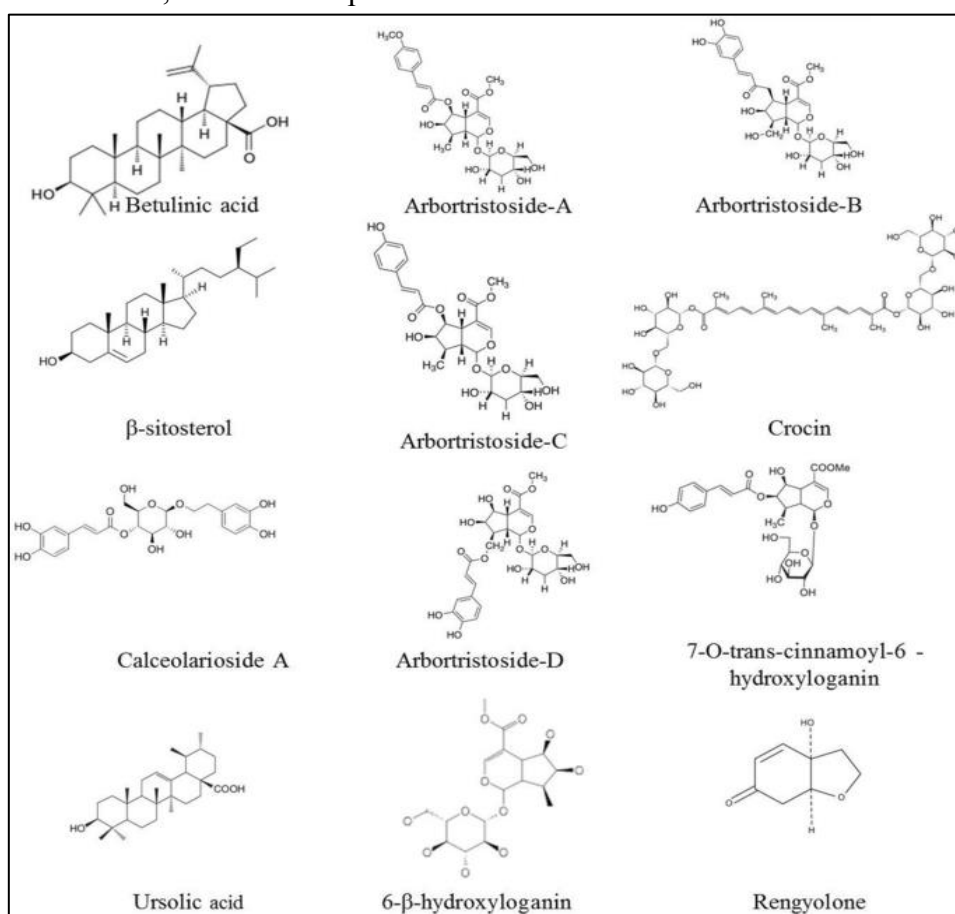


Fig 2. Structures of phytoconstituents of *Nyctanthes arbor-tristis*





### **Traditional Uses [23]**

Leaves: Antibilious, expectorant, used in rheumatism and fever, decoction given in sciatica, juice used as a cholagogue, laxative, diaphoretic, diuretic, liver disorder and anthelmintic.

Bark: Expectorant.

Seeds: Useful in baldness, scurvy and infections of the scalp.

Flowers: Bitter, ophthalmic, astringent, stomachic, carminative and trichogenous and are useful in inflammations, dyspepsia, flatulence, colic, ophthalmopathy, splenomegaly, greyness of hair and baldness.

### **Pharmacological Properties**

#### **Hepatoprotective**

Traditional knowledge has led to the testing of several parts of *N. arbor-tristis* for their hepatoprotective effects. In rats with carbon tetrachloride-induced liver damage, alcoholic preparations of the leaves were shown to effectively reduce blood glutamate pyruvate transaminase, oxalo-acetate transaminase, and serum bilirubin levels.<sup>118</sup> A comparable research looked at whether or not an ethanolic extract of the leaves could selectively reduce reactive oxygen species and hence block P450-mediated CCl<sub>4</sub> bioactivation at a dosage of 1g/kg.<sup>119</sup> Treatment with methanolic extracts of *N. arbor-tristis* leaf significantly increased the glutathione level in rats poisoned with 1g/kg of acetaminophen, demonstrating its hepatoregenerative potential. Another large study found that a 500 mg/kg dose of the plant's ethanolic and aqueous extract of its leaves was effective in hepatoprotection in rats with galactosamine-induced liver injury. Nyctanthesin, which has been linked to hepatoprotective function, has been found in the plant's leaves and seeds, according to recent research [24].

#### **Antioxidant and anti-cancer**

Plants have long been recognized as a source of powerful antioxidants, which help eliminate pathogen-causing free radicals. The order of the activity was as follows. The high phenolic and flavonoid content of the ethyl acetate leaf extract of *N. arbor-tristis* leaves was recently put to the test for its anti-oxidant potential. The hydro-alcoholic extract of the plant's leaves contains anti-lipid peroxidation properties, as well as anti-DPPH radical scavenging and anti-hydroxyl radical scavenging properties. Butanolic extract showed the greatest percentage of inhibition of the Reactive Oxygen Species (ROS), according to studies on numerous fractionated alcoholic extracts of the plant's leaves. Butanol (95.22%) > ethyl acetate (84.63%) > petroleum ether (82.04%) at 100 µg/ml as compared with reference standard of ascorbic acid at 10 µg/ml. Till date, there has not been much literature regarding the anticancer properties of *Nyctanthes arbor-tristis*. However, in a major study, it was reported that two iridoid glycoside exhibited anticancer activity against methylcholanthrene produced fibrosarcoma at 2.5 mg/kg in mice [25].



### **Anti-anxiety**

The anxiety-reducing effects of NAT hydroalcoholic extracts have been studied. Plant material for NAT was extracted using a hydroalcoholic combination, concentrated by distilling out the solvent, and then dried by evaporation on a water bath before being refrigerated in an airtight container [26].

### **Anti-inflammatory and analgesic**

The water-soluble fraction of the alcoholic extract of the leaves of NAT, as well as the alcoholic extracts of the stem and seeds, have all been shown to have anti-inflammatory effects, both acute and subacute. Acute anti-inflammatory effects are evaluated by administering the chemical to rats with histamine, formalin, 5-hydroxytryptamine, carrageenan, or hyaluronidase in the back of their paws. Using a granuloma pouch and a cotton pellet test, researchers discovered that NAT dramatically reduced the production of granulation tissue in sub-acute animals. The immunological techniques of Freund's adjuvant arthritis and the pure tuberculin response are both shown to be attenuated by NAT [27].

### **Anti-bacterial**

The greatest cause of mortality worldwide is infectious illnesses. It is becoming more frequent for different organisms such *Salmonella typhi*, *Staphylococcus epidermis*, *Staphylococcus aureus*, and *Salmonella paratyphi A* to be resistant to antimicrobial treatments and to exhibit multiple drug resistance. The MIC value of NAT methanolic extract against *Staphylococcus aureus*, *Salmonella typhi*, *Staphylococcus epidermis*, and *Salmonella paratyphi A* was found to be between 1 and 8 mg/ml [28]

### **Anti-aggressive**

Anti-aggressive properties were discovered in the freshly extracted juice of the plant's leaves. It has been shown that an ethanolic extract of the plant's seeds, leaves, roots, flowers, and stem possesses anti-amoebic and anti-allergic qualities. There were anti-inflammatory, analgesic, antipyretic, and ulcerogenic effects seen in the plant's leaf extract. Immunostimulant action of the plant has been attributed to its leaves, seeds, and flowers. The ethanolic extract's water-soluble fraction has been shown to have sedative, antihistamine, purgative, and tumor necrosis factor--depleting properties. The Arbortristis Side The seeds' isolated compound exhibited anticancer action [29].

### **Anti-diabetic**

Methanol extract of NAT root has anti-diabetic effects that are on par with those shown in diabetic control mice. The extract has potent and relatively risk-free anti-diabetic properties. 50 g of root powders were extracted with 400 mL of methanol using a hot continuous



extraction technique for 18 hours to produce the extract. Petroleum ether was used to filter and partition the methanolic extract to eliminate contaminants. Pressure and vacuum were used to evaporate the solvent. The resulting NAT dry extract was put to the test for its hypoglycemic effects. After seven days at 500 mg/Kg, it significantly lowers blood glucose levels in rats compared to the control medication. Blood glucose levels were shown to be reduced more effectively by a methanolic extract of NAT roots than by the gold standard medication [30].

### **Anti-malarial activity**

The effects of malaria treatment on 120 individuals. Within 7 days, 92 patients (76.7%) were healed after receiving fresh paste made from five medium-sized leaves of NAT three times daily for 7-10 days. Twenty more patients were cured within a week, but the last eight did not improve at all. No serious adverse reactions to the paste were documented. *Aedes aegypti*, *Culex quinquefasciatus*, and *Anopheles stephensi* are all significant mosquito vectors, and larvae of the latter were shown to be killed by both the methanol and chloroform extracts of leaves, with LC50 values of 244.4 and 747.7 ppm, respectively [31].

### **Anti-parasitic**

It has been reported that a crude ethanolic extract of leaves, at a concentration of 1000 g/mL, has trypanocidal action. The extract considerably increased the survival time of *Trypanosoma evansi*-infected mice when given at dosages of 300 and 1000 mg/kg, according to *in vivo* investigations. However, it has also been observed that the parasitaemia rises and the experimental animals die as soon as they stop receiving the extract. In hamsters infected with *Leishmania donovani*, NAT extract showed signs of having anti-leishmanial action. Clinical trials validated the anti-parasitic efficacy [32].

### **CONCLUSION**

It concluded that *Nyctanthes arbor-tristis* is rich source of numerous phytoconstituents and used traditionally in the management of various ailments. It has been reported for pharmacologically activities in various diseases i.e., anti-diabetic, anti-malarial, antioxidant, anticancer, anti-inflammatory and analgesic, antimalarial, antiparasitic, and anti-aggressive.

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Nil.

### **CONFLICT OF INTEREST**

Author declared for none conflict of interest.





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