Nyctanthes arbor-tristis: a comprehensive review
Jaspal Singh, Amar Pal Singh & Ajeet Pal Singh
St. Soldier Institute of Pharmacy, Lidhran Campus, Behind NIT (R.E.C), Jalandhar-Amritsar by pass NH-1 Jalandhar-144011, Punjab, India

Abstract
The Indian medicinal herb Nyctanthes arbor-tristis Linn. (NAT) is well-known. It is often referred to as "Parijat" and is a critically endangered species in India. Crude extracts and refined chemicals from seeds, such as 4-hydroxy-hexahydrobenzofuran-7-one, 6-hydroxyloganin, and Arbutristoside A, a polysaccharide from the leaves, and Naringenin from the stem, may all be sources of active pharmacological agents. In Ayurveda, the plant is used for a variety of pharmacological effects, including anticancer, antiparasitic, antimarial, immunostimulant, hepatoprotective, antiviral, anti-diabetic, and anti-allergy activity.

Introduction
For a long period of time, ancient works of literature have recorded the use of plants for therapeutic purposes. As a result of this recording of essential traditional knowledge about medicinal plants, many significant medicines have been developed in the contemporary age. Nyctanthes arbor-tristis L. (Oleaceae) is a significant medicinal plant that has been utilised for a variety of purposes throughout history. Numerous plant components have been utilised medicinally in traditional and indigenous cultures. Nyctanthes arbor-tristis is used in Ayurveda, Siddha-Ayurveda, and Yunani medicine as a laxative, diuretic, anti-venom, digestive, mild bitter tonic, and expectorant. Also called as Harshingar and Night jasmine, Nyctanthes arbor-tristis Linn (Magnoliophyta division; Magnoliopsida class; Lamiales order; Oleaceae family) (Class: Magnoliopsida; Order: Lamiales; Family: Oleaceae) (Division: Magnoliophyta; Class: Magnoliopsida; Order: Lamiales; Family: Oleaceae) [1-2]. It is a tiny native tree with rough and peeling grey or greenish bark. The shrub may reach a maximum height of ten metres. The opposite leaves are 6–12 cm long and 2–6.5 cm broad with a full edge, and the plant lives for 5–20 years. The fragrant blooms are clustered in groups of two to seven and have a five-to-eight lobed corolla with an orange-red centre. The powder white petals are clinging to dew droplets. The fruit is a flat, brown, and heart-shaped to spherical capsule divided into two parts, each of which contains a single seed and is about 2 cm in diameter [3-4]. It is found in the outer Himalayas and parts of Jammu and Kashmir, Nepal, and Assam, Bengal, and Tripura, extending from the central area to the Godavari in the south [5]. The plant is found across northern Pakistan and southern Nepal, as well as northern India and Thailand’s east coast. Due to its great therapeutic efficacy, it is now being investigated in biomedical science in order to create a more accurate therapeutic index in terms of active principles that may be the plant’s flag molecule. [6].

Vernacular Names [7-8]
English: Night jasmine, coral jasmine,
Hindi: Parja, Har, Siharu, Harsing har, saherwa, seoli, Nibari, Shefali.
Kannada: Parijata, harshingar
Odia: Shingadahar, harshingar, gangaseuli, jharasephali
Tamil: Pavilamalligai, manja-pu, pavazahamalligai
Telugu: Pagadammali, swetasarasa, paghada, karchia, karuchiya
Malayalam: Pavilamalli, parijatam, pavizhamallili, parijatakam
Marathi: Khurasli, Parijataka, Purijat

Classification of study drug [9]
Kingdom: Plant
Order: Lamiales
Family: Oleaceae

CODEN (CAS-USA): WJCMCF
Genus: Nyctanthus  
Species: Arbortristis

**Etymology [10]**

"Paarinaha Samudrath jaatho va parijatah" is the etymology of Parijata: It is known as Parijata because it originated in the Samudra (Ocean) as a consequence of (parinaha) thorough searching.

**Synonyms of Parijata [11]**

Parijata is referred to by a variety of names in many classics. Its many names alludes to physical features such as colour, fragrance, and flower and leaf use. Synonyms include parajataa, hara-singhara, sephali, raga-pushpi, kahrapatrak, sephalika, pushpaka, nala-lumkuma, prajakta, and rakta-kesara.

**Traditional pharmacological properties**

Parijata has traditionally been used for its pharmacological characteristics such as rasa (katu, tikta, guna-ruksha, virya-ushna), guna, virya, and vipaka. It is a component in many chemical compositions. Generally, the leaves, roots, flowers, and seeds of Parijata are used in a variety of dosage forms, including juice, powder, and decoction, to treat a variety of illnesses. It is particularly used to treat illnesses caused by vata and kapha vitiation [12-13].

| Plant parts | Chemical constituents |
|-------------|-----------------------|
| Leaves [14-15] | D-mannitol, -sitosterone, astragalone, nicotiflorin, oleanic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, carotene, friedeline, lupeol, mannitol, glucose and fructose, iridoid glycosides, benzoic acid. |
| Flowers [16-17] | Essential oil, nyctanthin, d-mannitol, tannin and glucose, carotenoid, glycosides viz β-monogentiobioside ester of α-crocin (or crocin-3), β-monogentiobioside-β-D-monoglucoside ester of α-crocin, β-digentiobioside ester of α-crocin |
| Seeds [18] | Arbortristoside A&B, Glycerides of linoleic oleic, lignoceric, stearic, palmitic and myristic acids, nyctanthic acid, 3-4 seco triterpene acid. |
| Stem [19] | Glycoside-naringenin-4'-0-β-glucopyranosyl-α-xlyopyranoside and β-sitosterol |
| Flower [20] | Oil α-pinene, p-cymene, 1- hexanol methyl heptanone, phenyl acetaldehyde, 1-deconol and anisaldehyde. |
| Bark [21] | Glycosides and alkaloids |

**Fig 02:** Pharmacological activities of Nyctanthes arbor-tristis Linn
Pharmacological Activities
Pharmacological activities are shown in figure 2 and discussed in details following are

Anticancer activity
The first study on N. arbortristis’ anticancer efficacy was published in 2001, by researchers who discovered that petroleum ether, chloroform, and ethyl acetate extracts of the flowers had substantial cytotoxic activity. In Swiss albino rats, a methanolic extract of stem bark was shown to have considerable anticancer efficacy when compared to 5-fluorouracil against Dalton’s ascitic lymphoma. The cytotoxicity of the ethanolic, methanolic, and aqueous leaf extracts against the T-cell leukaemia cell increases with time and dosage. At all doses and time periods, the extracts showed a significant reduction in normal cell toxicity [22].

Antiparasitic activity
A crude 50 percent ethanolic extract of leaves was found to exhibit trypanocidal activity at a concentration of 1000 Ogm/mL. In vivo experiments showed that the dosage of 300 and 1000 mg/kg, i.p., the extract had antitrypanosomal actions and substantially extended the life time of Trypanosoma evansi-infected mice. However, it has been observed that once the extract therapy is stopped, the parasitaemia rises, resulting in the death of the experimental animals [23].

Antimalarial activity
A clinical study including 120 malaria patients was conducted. A fresh paste of medium-sized five leaves of N. arbortristis administered three times daily for seven days cured 92 (76.7 percent) of patients. The remaining 20 patients recovered within ten days, while the other eight did not respond to treatment. The paste was well-tolerated, and no severe side effects were seen. [24].

Immunostimulant activity
Oral administration of ethanolic extract of NAT at dosages of 50, 100, 150, and 200 mg/kg significantly enhanced circulating antibody titres when challenged with SRCS and heat-killed Salmonella antigens. Chronic therapy raised the overall WBC count and significantly enhanced the DTH response. The extract was found to include 21 immune-reactive chemicals. [25].

Hepatoprotective activity
The antihepatotoxic efficacy of aqueous extracts of Nyctanthes arbor-tristis leaves and seeds against carbon tetrachloride (CCl4) caused hepatotoxicity was discovered [26]. Hepatic diseases have become significant roadblocks for medicine in the twenty-first century. Hepatic tissue has a high capacity for regeneration, and damage is typically substantial before it becomes apparent. Hepatic disorders develop itself when hepatocyte regeneration does not keep up with damage, resulting in hepatocellular failure [27].

CNS depressant action
The leaves, flowers, seeds, and barks of NAT (600 mg/kg) were found to significantly and dose-dependently prolong sleep onset and duration and to cause a decrease in dopamine and an increase in serotonin levels, implying that the CNS depressant activity of the ethanol extracts of seeds, leaves, and flowers is due to a decrease in dopamine [28].

Anti-inflammatory activity
A water soluble ethanolic extract of NAT leaves was used in a study to determine the presence of anti-inflammatory activity. NAT inhibited acute inflammatory edema in the hind paw of rats induced by several phlogistic agents, including carrageenin, formalin, histamine, 5-hydroxytryptamine, and hyaluronidase. Turpentine oil was shown to be effective in reducing acute inflammatory edema in rats’ knee joints. [29].

Antiviral Activity
The ethanolic extract, n-butanol fractions, and two pure compounds from the NA show a strong inhibitory impact against encephalomyocarditis virus (EMCV) and Semliki forest virus (SFV). The in-vivo ethanolic extract and the n-butanol fraction protected EMCV-infected mice against SFV by 40% and 60%, respectively, at daily doses of 125mg/kg weight. [30].

Anti-Diabetic Activity
In comparison to diabetic controls, oral administration of chloroform and ethanolic leaf and flower extracts significantly increased superoxide dismutase (SOD) and catalase (CAT) levels and significantly decreased liver lacto peroxidase (LPO), serum SGPT, SGOT, and alkaline phosphatase, cholesterol, and triglyceride levels. When diabetic rats treated with streptozotocin-nicotinamide were given an ethanolic extract of the stem bark, it demonstrated significant anti-diabetic activity. The extract lowers blood glucose levels dose-dependently. [31].

Anti-Allergy Activity
Pretreatment with a water soluble portion of an alcoholic extract of NA leaves avoided suffocation in guinea pigs exposed to histamine aerosol. Arbortistoside A and arbortristoside C have been shown to have anti-allergic effects in NA [32].

Anti-Trypanosomal Potential
In vitro and in vivo antitrypanosomal activity of a crude 50% ethanolic extract of N. arbor-tristis leaves was investigated. At the highest concentration tested (1000 g/ml), the extract showed trypanocidal action [33].

Sedative Effects
The hot infusion of N. arbo-tristis flowers may have sedative properties. A variety of concentrations of hot floral infusion were prepared and given orally. Two hours after treatment, the sedative potential was determined. Male rats had a modest dose-dependent conscious sedation effect from the injection, while female rats did not. Even after subchronic therapy, the infusion was well tolerated in terms of overt toxic symptoms, liver or kidney function, and did not exhibit any overt indications of dependency [34].

Antianemic Activity
A haematological research using ethanolic extracts of the flowers, barks, seeds, and leaves of the plant showed a dose-dependent rise in the haemoglobin content and red blood cell count in rats. Additionally, the extracts prevent anaemic rats’ hemoglobin profiles from degradation. [35, 5].

Anti Histaminic and Anti-Tryptaminergic activity
The aqueous soluble extract of N. arbor-tristis leaves (4.0 and 8.0g/kg oral) successfully prevents guinea pigs from hypoxia caused by histamine aerosols (2 percent at 300 mm Hg). In N. arbor-tristis, arbortristosid A and arbortristosid C were shown to be anti-allergic. [36].

Anti-Aggressive Activity

[76] CODEN (CAS-USA): WJCMCF
Fresh juice derived from the leaves of the plant was shown to have antimalarial activity. The plant’s seeds, leaves, roots, flowers, and stem have been found to have antibacterial and antiallergic properties in a 50 percent ethanolic extract. The leaf extract of the plant was shown to have anti-inflammatory, analgesic, antipyretic, and allergenic effects. Immunostimulant effects have been discovered in the leaves, seeds, and flowers of the plant. Sedative, antihistamine, purgative, and tumour necrosis depletion activities have been shown for the water soluble part of the ethanolic extract. Arbortristoside, isolated from the seeds, showed anticancer properties [37].

**Anti-Filarial activity**

Both the chloroform extract of the flowers and a purified constituent of the N. arbortristis plant are larvicidal against the common floral vector Culex quinquefasciatus [38].

**Anti-Leishmanial Activity**

The anti-leishmanial activity of N. arbortristis has been attributed to iridoid glucosides, arbortristosides A, B, and C, as well as 6-b-hydroxyloganin. Arbortristosides A, B, C, and 6-beta-hydroxy-loganin were shown to be anti-leishmanial in macrophage cultures and hamster test systems, respectively [39].

**Anti-arthritis activity**

Arthritis is a progressive degenerative condition that starts with joint pain and proceeds to bone and joint deterioration. Cytokines have a major role in the pathogenesis of rheumatoid arthritis. Previously, it was shown that aberrant tumour necrosis factor (TNF-α) expression resulted in debilitating arthritis in experimental animals. In the absence of interleukin-1 (IL-1), the development of arthritis was substantially decreased in collagen-induced arthritis (CIA). Mice missing the interleukin-6 (IL-6) gene were resistant to arthritis caused by antigens and collagen. These studies showed that pro-inflammatory cytokines (TNF-α, IL-1, and IL-6) have a role in rheumatoid arthritis and may represent therapeutic targets. [40]

**Antioxidant activity**

In a living organism, free radicals are generated as a consequence of the body’s normal metabolic activity. Antioxidants act as free radical scavengers, defending the body against pathological conditions such as ischemia, anaemia, asthma, rheumatoid arthritis, inflammation, neurodegeneration, Parkinson’s disease, mongolism, the ageing process, and perhaps dementias. According to prior study, NAT’s antioxidant activity was determined using the DPPH test, free radical scavenging activity, reducing power assay, and total antioxidant capacity. The plant was shown to have a significant degree of antioxidant activity. [41].

**Conclusion**

Plants offer a wide range of pharmacological properties that may be therapeutically beneficial for population health and well-being; thus, further clinical research is urgently required. So far, all pharmacological research has been preliminary such as Anticancer activity, Antiparasitic activity, Antimalarial activity, Immunostimulant activity, Hepatoprotective activity, Anti-inflammatory activity: Antiviral Activity, Anti-Allergy Activity, Anti-Diabetic Activity, Anti-Histaminic and Anti-Tryptaminergic activity, Anti-Aggressive Activity, Anti-Filarial activity, Anti-Leishmanial Activity, Antioxidant activity, Anti-arthritis activity. In these studies, the bioactive chemical must be discovered and described, as well as the molecular mechanism of action.

**Disclosure Statement**

There are no conflicts of interest.

**Acknowledgment**

It’s our privilege to express profound sense of gratitude and cordial thanks to our respected chairman Mr. Anil Chopra, Vice Chairperson Ms. Sangeeta Chopra & Pro-Chairman Mr. Prince Chopra, St. Soldier Educational Society, Jalandhar for providing the necessary facilities to complete this work.

**References**

1. Kiew R, Bass P. Nyctanthes is a member of the Oleaceae. Proc Indian Acad Sci (Plant Sci.) 1984; 93(3):349–58.
2. Khare CP. Indian herbal remedies: Rationale western therapy, ayurvedic & other, 2004; 332.
3. Lal JB. Construction of the colouring matter of Nyctanthes arbortristis. Identity of Nytanthin with K-crocin. 1936; 2: 57-61.
4. Das S, Sasmal D, Basu SP. Antispasmodic and anthelmintic activity of Nyctanthes arbortristis. Linn. International Journal of Pharmaceutical Sciences and Research 2010; 1: 51-55.
5. Jain PK, Pandey A. The wonder of Ayurvedic medicine—Nyctanthes arbortristis. Int J Herbal Med 2016; 4(4):9–17.
6. Hara H, Chater AO, Williams LHJ. An enumeration of the flowering plants of the Nepal, 1978-1982.
7. http://www.flowersofindia.net , visited on 15/02/2007
8. Wealth of India, A Dictionary of Indian Raw Materials and Industrial Products, Vol.VI, (National Institute of Science Communication, CSIR ,New Delhi, 1997) 69-70.
9. http://www.impgc.com , visited on 15/02/2007
10. Acharya Sharma PV, Priya Nighantu, 1st edition, Haritakyadi Varga, Verse 190-92, Page-42/192, Chowkhabma Surabharati Prakashana, Varanasi, (2004).
11. Bapalal G Vaidya, Nighantu Adarsha, 1st edition, Vol-I, Jatyadi Varga, Page No.- 838;Chawkhabma Vidya bhavan, (1968).
12. Acharya Lala Shaligramya Vaishya,Shalgramya Nighantu, commentary by Pt. Shankar Lal Harishankar, 3rd edition, 4threprint, Page No. .520, Shri Krishnadas Prakashana Bombay, (1995).
13. Acharya Pt. Narahari, Raja Nighantu, Dravyaguna Prakashika Hindi commentary by Indradev Tripathi, Chapter: B, Verse: 129, Page No: 257, Chowkhabma Krishna Das Academy, Varanasi, Fourth Edn: (2006).
14. Mahida Y, Mohan JSS, Screening of plants for their potential antibacterial activity against Staphylococcus and Salmonella spp., Nat Prod Rad 2007; 6(4):301-305.

CODEN (CAS-USA): WJCMCF
15. Hulkeri VI, Akki KS, Sureban RR, Gopalakrishna B, Byahatti VV, Rajendra SV. Hepatoprotective activity of the leaves of Nyctanthes arbor-tristis Linn. Ind J Pharm Sci 2006;68(4):542-543.
16. Rathee JS, Hassarajani SA, Chattopadhyay S. Antioxidant activity of Nyctanthes arbor-tristis leaf extract, Food Chem, 2007; 103:1350–1357.
17. Thangavelu NR, Thomas S. In-vitro anti-oxidant studies on ethanolic extracts of leaves and stems of Nyctanthes arbor-tristis L. (Night flowering Jasmine), Int J Biol Med Res 2010; 1(4):188-192.
18. Adebajo AC, Aladesanmi AJ, Akinkinmi EO, Taiwo BJ, Olorunmola FO, Lamikanra A. Antimicrobial and antioxidant activities of some Nigerian medicinal plants, African J Trad CAM 2007;4(2):173-184.
19. Girach RD, Aminuddin SA, Siddiqui PA & Khan SA, Ethnomedicinal studies on Harsinghar (Nyctanthes arbor-tristis L)- A less known medicinal plant in Unani medicine, Hamdard Med 1994; 37(2):60-66.
20. Chandra G, Chemical composition of the flower oil of Nyctanthes arbor-tristis Linn. Indian Perfumer 1970; 14(1):1-19.
21. Vats M, Sharma N, Sardana S. Antimicrobial Activity of Stem Bark Extracts of Nyctanthes arbor-tristis Linn. (Oleaceae), Int J Pharmacog Phytochem Res 2009; 1(1):12-14.
22. Khatune NA, Islam ME, Abdur Rahman MA, Mosaddik MA, Haque ME. In vivo cytotoxic evaluation of new benzofuran derivative isolated from N. arbor-tristis L. on ehrlich ascite carcinoma cells in mice. J Med Sci 2003; 3(2):169-173.
23. Chitravanshi VC, Singh AP, Ghoshal S, Prasad K, Srivastava V, Tandon JS. Therapeutic action of Nyctanthes arbor-tristis against Caecalamoebiasis of rat. Int J Pharmacog 1992; 30: 71-75.
24. Karnik SR, Tatham PS, Antarkar DS, Gidse CS, Vaidya RA, et al. Antimalarial activity and clinical safety of traditionally used Nyctanthes arbor-tristis Linn. Indian Journal of Traditional Knowledge 2008; 7: 330–334.
25. Kumar S, Gupta P, Sharma S, Kumar D. A review of immunostimulatory plants. Journal of Chinese Integrative Medicine 2011; 9: 117-128.
26. Lucas DS, Sekhar RAR, A review of experimental studies on antihepatoprotective activity of certain medicinal plants used in Ayurveda, Phytomedicine, Supplement-I (2000) 23.
27. Vishwanathan M, Juvekar AR. Hepatopregenerative effects of Nyctanthes arbor-tristis Linn. on acetaminophen induced oxidative damage in rats. International Journal of Pharmaceutical Technology and Research 2010; 2: 1291-1297.
28. Das S, Sasmal D, Basu SP. Evaluation of CNS depressant activity of different parts of Nyctanthes arbor-tristis. Indian Journal of Pharmaceutical Science 2008; 70: 803-806.
29. Saxena RS, Gupta B, Saxena KK, Prasad DN. Study on anti-inflammatory activity in leaves of Nyctanthes arbor-tristis. Journal of Ethnopharmacology 1984; 11: 319-330.
30. Surekha B Barwal, Mohammed Shakir Ghouse, Amruta S Wattamwar, Ajit M Murkute. A Comprehensive Review on Night-flowering Jasmine Nyctanthes arbor-tristis. Journal of Medical and Pharmaceutical Innovation 2017; 4(19): 1-6.
31. Sharma V, Pooja Marwaha A. Hypoglycemic activity of methanolic extract of Nyctanthesarbor-tristis Linn. root in alloxan induced diabetic rats. International Journal of Pharmacy and Pharmaceutical Sciences 2011; 3(3): 210-212.
32. Rathee JS, Hassarajani SA, Chattopadhyay A. Antioxidant activity of Nyctanthesarbor-tristis leaf extract, Food chem.2007; 103(4):1350-1357.
33. Talakal TS, Dwivedi SK, Shamra SR. In vitro and in vivo antitrypanosomal potential of Nyctanthes arbor-tristis leaves. Pharmaceutical Biology 2000; 38: 326-329.
34. Ratnasooriya WD, Jayakody JRAG, Hettiarachchi ADL, MG. Sedative effects of hot flower infusion of Nyctanthes arbor-tristis on rats. Pharmaceutical Biology 2005; 43: 140-146.
35. Jain R, Mittal M. A review on pharmacological and chemical documentation of N. arbor-tristis Linn. Asian Journal of Traditional Medicine, 2011; 6(5): 187-203.
36. Chatterjee SK, Bhattacharjee I. Bactericidal Activities of some common herbs of India, Pharmaceutical Biology. 2007; 45(5):350-54.
37. Indian Medicinal Plant Nyctanthes arbor-tristis Linn. World Applied Sciences Journal. 2013; 11(5):495-503.
38. Khatu na, haue me, mosaddik ma. Laboratory evaluation of Nyctanthes arbo-tristis linn. Flower extract and its isolated compound against common filarial vector, culex quinquefasciatus say. (diptera:fulicidea) larvae. pak. J bio sci. 2001; 4(5):585-87.
39. Singh UK, Guru PY, Sen AB, Tandon JS. Antileishmanial activity of traditional plants against Leishmania donovani in golden hamsters. Int J Pharmacog. 1992; 30: 289-95.
30. Rathore B, Paul B, Claudhary BP, Saxena AK, Sahu AP, Gupta YK. Comparative studies of different organs of Nyctanthes arbor-tristis in modulation of cytokines in murine model of arthritis. Biomedical and Environmental Sci 2007; 20: 154-159.
41. Narendhirakannan RT, Smeera T. In-vitro antioxidant studies on ethanolic extracts of leaves and stems of Nyctanthes arbor-tristis L. (Night-flowering jasmine) International Journal of Biology and Medical Research 2010; 1: 188-192.