WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 12, Issue 11, 78-92. Review Article ISSN 2277– 7105

PHARMACOGNOSTIC, PHYTOCHEMICAL PHARMACOLOGICAL REVIEW OF NYCTANTHES ARBOR- TRISTI

Priyanka K. Shinde, Anil B. Waghmode* and Chandrashekhar J.Waghmare

Department of Pharmacognosy JBVP's Vidhyaniketan College of Pharmacy,Lakhewadi, Tal – Indapur, Dist. – Pune, Maharashtra, India.

Article Received on
12 May 2023,

Revised on 02 June 2023,
Accepted on 22 June 2023

DOI: 10.20959/wjpr202311-28512

***Corresponding Author**
Anil B. Waghmode
Department of Pharmacognosy JBVP's Vidhyaniketan College of Pharmacy, Lakhewadi, Tal – Indapur, Dist. – Pune, Maharashtra, 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 Arbortristoside 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, antimalarial, immunostimulant, hepatoprotective, antiviral, anti-diabetic, and allergic activity.

KEYWORDS: Nyctanthes arbortristis, Traditional, Phytochemistry profile, Pharmacology activity.

INTRODUCTION

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 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 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 plantlives 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 Jammuand 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 andsouthern 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 theplant's flag molecule.[6]

Fig. 01: Nyctanthes arbor-tristis or night jasmine.

Vernacular names[7-8]

English: Night jasmine, coral jasmine,

Hindi: Parja, Har, Siharu, Harsing har, saherwa, seoli, Nibari, Shefali.

Kannada: Parijata, harashingar

Odia: Shingadahar, harashingar, gangaseuli, jharasephali

Tamil: Pavilamalligai, manja-pu, pavazahamalligai

Telagu: Pagadammali, swetasarasa, paghada, karchia, karuchiya

Malayalam: Pavilamalli, parijatam, pavizhamalli, parijatakam

Marathi: Khurasli, Parijataka, Purijat

Classification of study drug[9]

Kingdom: Plant Order: Lamiales Family: Oleaceae Genus: Nyctanthus Species: Arbortristis

Etymology.[10]

"Paarinaha Samudrath jaatho va parijatah" is the etymology of Parijata: It is knownas 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 alludesto physical features such as colour, fragrance, and flower and leaf use. Synonyms include parajataa, hara-singhara, sephali, raga-pushpi, kahrapatrak, sephalika, pushpaka, nala-kumkuma, 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]

Table 01: Chemical constituents of *nyctanthes arbortristis.*

Plant parts	Chemical constituents
Leaves[14-15]	D-mannitol, -sitosterole, astragaline, nicotiflorin, oleanolic acid, nyctanthic acid, tannic acid, ascorbic acid, methyl salicylate, carotene, friedeline, lupeol, mannitol, glucoseand fructose, iridoid glycosides, benzoic acid.
Flowers[16-17]	Essential oil, nyctanthin, d-mannitol, tanninand glucose, carotenoid, glycosides viz β- monogentiobioside ester of α-crocetin (or crocin-3), β-monogentiobioside-β-D monoglucoside ester of α-crocetin, β-digentiobioside ester of α-crocetin
Seeds [18]	Arbortristoside A&B, Glycerides of linoleic oleic, lignoceric, stearic, palmitic and myristicacids, nyctanthic acid, 3-4 secotriterpene acid.
Stem[19]	Glycoside-naringenin-4'-0-β-glucapyranosyl-α-xylopyranoside and β-sitosterol
Flower[20]	Oil α-pinene, p-cymene, 1- hexanol methylheptanone, phenyl acetaldehyde, 1-deconoland anisaldehyde.
Bark[21]	Glycosides and alkaloids

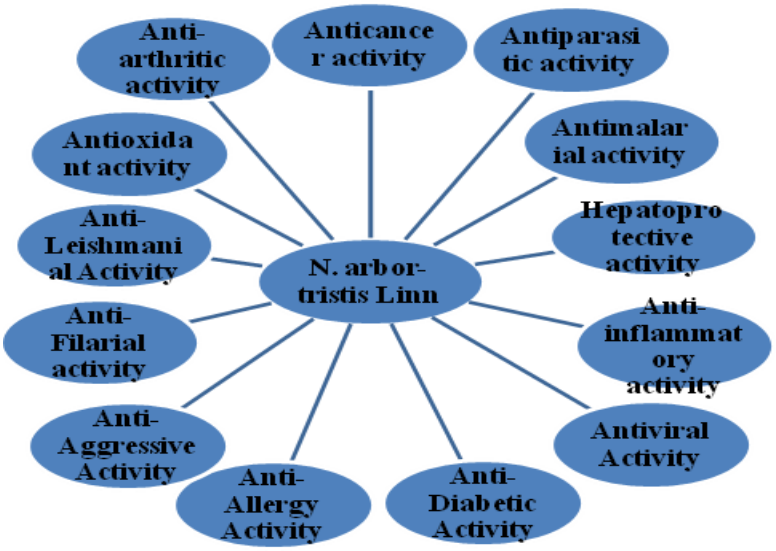

Fig. 02: Pharmacological activities of nyctanthes arbor-tristis linn.

➢ **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 Og/mL. In vivo experiments showed that at dosages 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

Sized five leaves of N. arbortristis A clinical study including 120 malaria patients was conducted. A fresh paste of medium-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-bioactive 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 edoema 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 edoema in rats' knee joints.[29]

Antiviral activity

The ethanolic extract, n-butanol fractions, and two pure compounds extracted 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 ethanol 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' hemogram 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

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-arthritic 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-) 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 shown that pro-inflammatory cytokines (TNF-, 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]

Phythochemical study

Table 1: Phytochemical analysis of nyctanthes arbor- trisIS.

Test	Observation
Test for alkaloid	
1.0ml of plant extract was taken and then add 1.0 ml of saturated solution of picric acid wasadded	Yellow colour appearS
Test for tannins	
About 0.5 g of the extract was boiled in 10 ml of water in a test tube and then filtered. A fewdrops of 0.1 fecl3 was added	Brownish green or blue- black coloration
Test for saponins	
• 0.5g of extract was added in 5ml of distilledwater in a test tube. The solution was shaken vigorously. The frothing was mixed with 3 drops of olive oil and shaken vigorously	Stable persistent froth appears. Formation of an emulsiony
Test for cardiac glycoside	
0.5g of extract was diluted to 5 ml in water was added 2 ml of glacial acetic acid containing one drop of feCl3. This was underlaid with 1 ml of conc. Sulphuric acid.	A brown ring at the interface. A violet ring was appeared below the brownring. Greenish ring may form just above the brownring.
Test for tarpenoids	
5 ml of extract was mixed with 2 ml of chloroform and 3 ml of conc. H2SO4 was carefully added to form a layer.	A reddish brown coloration of the interface wasformed
Test for pheno	
2 ml of extract was taken and add 2 ml of Folin‟s reagent	Appearance of violet or brown colour.
Test for Flavonoids	
5 ml of dil. Ammonia solution were added to aportion of the crude extract followed by addition of conc. H2SO4.	Yellow coloration occurs
Carbohydrates : Moliseh's test	

To 2ml of the extract, add l ml of α-naptholsolution, add concentrated sulphuric acid through the side of the test tube.	Purple or reddish violet colour at the junction ofthe two liquids reveals the presence of carbohydrates
Fehling's test	
To 1 ml of the extract, add equal quantities of Fehling solution A and B, upon heating F	Formation of a brick red precipitate indicates the presence of sugars
Benedict's test	
To 5ml of Benedict's reagent, add 1ml of extract solution and boil for 2 minutes and cool.	Formation of red precipitate shows the presence of sugars
Test For Anthraquinone Glycoside	
To 200 mg of each extracts, dil. sulphuric acid was added and boiled. Then it was filtered and cooled. To the cold filtrate, 3 ml of benzene wasadded and mixed. The benzene layer was seprated and to it ammonia (2ml) was added	Ammonical layer was observed.
Test for proteins and amino acids	
Biuret test	
Add 1 ml of 40% sodium hydroxide solution and2 drops of 1% CuSO4 solution till a blue colour is produced, and then add 1 ml of the extract	Formation of pinkish or purple violet colour indicates the presence of proteins

Table 2: Phytochemical evaluation of nyctanthes arbortristis.

Chemical Test	Result
Test for Alkaloid	Positive
Test for Tannins	Positive
Test for Saponins	Positive
Test for Cardiac glycoside	Positive
Test for Tarpenoids	Positive
Test for Phenol	Positive
Test for Flavonoids	Negative
Test for Carbohydrates :Moliseh's test Benedict's test: Fehling's test	PositivePositive Positive
Test for Anthraquinone Glycosides	Negative
Test for proteins and amino acids Biuret test:	Positive

Pharmacognostical study

Macroscopical study: The macroscopic and "organoleptic characters of the leaves were experimental, i.e. shape, scale, colour, odour, margin, texture, taste,apex even petiole".

Table 1: Macroscopic study of *N. arbor-tristis* Linn. Leaf.

Plant Part and Characters	Observation
Part	Leaves
Colour	Light to dark green
Odour	Indistinct
Taste	Bitter and astringent
Size	5-15 cm long, 2.5-5.7 cm wide
Texture	Rough
Shape	Heart
Base	Oblique
Margin	Entire
Apex	Acute
Venation	Reticulate

Microscopy study

During the midrib convex project resting on the inferior field, the leaf of *Nyctanthes arbor-tristis* was cut, also faintly wavy between a thin middle rise going to the superior sector. A small number of collenchymal coatings lie below each other's epidermis, with the superior coating positioned nearby on the curved xylem hole. The unicellular trichomes of various sizes produce cystolite on the bottom of the bear plain layer. Glandular trichomes were also close to a bicellular top overflowing by gloomy tanned satisfied among single-cell shadow.

The higher epidermis of the lamina cell was walled broadly quite instantly with stomata devoid. Two rows of epidermis are seen in the lamina near the midrib. By sinous stockade on spaces, cuticle striated with slanting with regular anomocytic stomata, the cell of the inferior epidermis is smaller in amount than that of the upper one. Two rows of pole cells lie in the higher epidermis, “followed by 7-9 rows of soft parenchyma transversed near vascular bundles often surrounded by parenchyma cell”.

a) T. S. leaves of NAT mid-rib

(c) Trichome

(b) Vascular bund

- **Powder microscopy**

Nyctanthes arbor-tristis "powder microscopy" reveals the occurrence of starch grains, palisade cells, trichomes, phloem and xylem vessels. This includes the histological study of the tissue preparation type, the occurrence of quality characteristics "such as trichome and starch grain using a magnification microscope", for example.

(a) Starch grains

(c) Phloem vessels

(b) Trichomes

(d) xylem vessels

Table 2: Observation of *Nyctanthes arbor-tristis* L. leaf extract.

Extract study	Observation
Plant parts	Dried and powdered leaves
Extraction process	Simple maceration

Solvent	Ethanol (80% v/v)
Colour	Dark green
Texture	Greasy
Odour	Indistinct
Soluble	Water and alcohol
Insoluble	Acid
Practical yield	3.24 gm
Percentage yield	6.48% w/w

- **TLC Profile**

Thin layer chromatography of purified sample of *Nyctanthes arbor-tristis* was performed".

Table 3: TLC Finger Printing of ethanolic extract of leaf of *Nyctanthes arbor-tristis* Spots

Solvent system	Solvent run (cm)	Solute run (cm)	Rf value
Ethyl acetate: methanol: water (77: 15:8)	7.3	7.1	0.97

TLC plate of ethanol extract of *Nyctanthes arbor-tristis.*

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, Ant parasitic activity, Antimalarial activity, Immunostimulant activity, Hepatoprotective activity, Anti-inflammatory activity: Antiviral Activity, Anti-Diabetic Activity, Anti-Allergy Activity, Anti-Histaminic and Anti-Tryptaminergic activity, Anti-Aggressive Activity, Anti-Filarial activity, Anti-Leishmanial Activity, Antioxidant activity, Anti-arthritic activity. In these studies, the bioactive chemical must be discovered and described, as well as the molecular mechanism of action.

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. Constitution of the colouring matter of Nyctanthes arbortristis. Identity of Nyctanthinwith K-crocetin, 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 arbor- tristis. 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, VII, (National Institute of Science Communication, CSIR, New Delhi) 1997; 69-70.
9. Kiew R, Bass P. Nyctanthes is a member of the Oleaceae. Proc Indian Acad Sci (Plant Sci.), 1984; 93(3): 349–58.
10. Khare CP. Indian herbal remedies: Rationale western therapy, ayurvedic & other, 2004; 332.
11. Lal JB. Constitution of the colouring matter of Nyctanthes arbortristis. Identity of Nyctanthinwith K-crocetin, 1936; 2: 57-61.
12. Das S, Sasmal D, Basu SP. Antispasmodic and anthelmintic activity of Nyctanthes arbortristis Linn. International Journal of PharmaceuticalSciences and Research, 2010; 1: 51-55.
13. Jain PK, Pandey A. The wonder of Ayurvedic medicine—Nyctanthes arbor- tristis. Int J Herbal Med, 2016; 4(4): 9–17.
14. Hara H, Chater AO, Williams LHJ. An enumeration of the flowering plants of the Nepal, 1978-1982.
15. http://www.flowersofindia.net , visited on 15/02/2007

16. Wealth of India, A Dictionary of Indian Raw Materials and Industrial Products, VII, (National Institute of Science Communication, CSIR, New Delhi) 1997; 69-70.
17. http://www.impgc.com , visited on 15/02/2007
18. Acharya Sharma PV, Priya Nighantu, 1st edition, Haritakyadi Varga, Verse Chowkhamba Surabharati Prakashana, Varanasi, 2004; 1: 190-92, 42 - 192.
19. Bapalal G Vaidya, Nighantu Adarsha, Jatyadi Varga, Chawkhamba Vidya bhavan, 1968; 1: 83 – 8.
20. Acharya Lala Shaligrama Vaishya,Shaligrama Nighantu, commentary by Pt. Shankar Lal Harishankar, Shri Krishnadas Prakashana Bombay, 1995; 3, 4: 520.
21. Acharya Pt. NaraHari, Raja Nighantu, Dravyaguna Prakashika Hindi commentary by Indradev Tripathi, Chapter: Chowkhamba Krishna Das Academy, Varanasi, Fourth Edn, 2006; 8, 129: 257.
22. Mahida Y, Mohan JSS, Screening of plants for their potential antibacterial activity against Staphyllococcus and Salmonella, Nat Prod Rad, 2007; 6(4): 301-305.
23. Hukkeri 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.
24. Rathee JS, Hassarajani SA, Chattopadhyay S. Antioxidant activity of Nyctanthes arbor-tristis leaf extract, Food Chem, 2007; 103: 1350–1357.
25. Thangavelu NR, Thomas S. In-vitro anti-oxidant studies on ethanolic extractsof leaves and stems of Nyctanthes arbor-tristis (Night flowering Jasmine), Int J Biol Med Res, 2010; 1(4): 188-192.
26. Adebajo AC, Aladesanmi AJ, Akinkimi 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.
27. Girach RD, Aminuddin SA, Siddiqui PA & Khan SA, Ethnomedicinal studies on Harsinghar (Nyctanthes arbor-tristis)- A less known medicinal plant in Unani medicine, Hamdard Med, 1994; 37(2): 60-66.
28. Chandra G, Chemical composition of the flower oil of Nyctanthes arbor-tristis Indian Perfumer, 1970; 14(1): 1-19.
29. Vats M, Sharma N, Sardana S. Antimicrobial Activity of Stem Bark Extracts of Nyctanthes arbor-tristis (Oleaceae), Int J Pharmacog Phytochem Res, 2009; 1(1): 12-14.
30. Khatune NA, Islam ME, Abdur Rahman MA, Mosaddik MA, Haque ME. In vivo cytotoxic evaluation of new benzofuran derivative isolated from N. arbortristis L. on

ehrlich ascite carcinoma cells in mice. J Med Sci, 2003; 3(2): 169-173.

31. 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.
32. Karnik SR, Tathed PS, Antarkar DS, Gidse CS, Vaidya RA, et al. Antimalarial activity and clinical safety of traditionally used Nyctanthes arbortristis Linn. Indian Journal of Traditional Knowledge, 2008; 7: 330–334.
33. Kumar S, Gupta P, Sharma S, Kumar D. A review of immunostimulatory plants. Journal of Chinese Integrative Medicine, 2011; 9: 117-128.
34. Lucas DS, Sekhar RAR, A review of experimental studies on antihepatoprotective activity of certain medicinal plants used in Ayurveda, Phytomedicine, Supplement, 2000; 2: 23.
35. Vishwanathan M, Juvekar AR. Hepatoregenerative effects of Nyctanthes arbortristis on acetaminophen induced oxidative damage in rats. International Journal of Pharmaceutical Technology and Research, 2010; 2: 1291-1297.
36. Das S, Sasmal D, Basu SP. Evaluation of CNS depressant activity of different parts of Nyctanthes arbortristis. Indian Journal of Pharmaceutical Science, 2008; 70: 803-806.
37. Saxena RS, Gupta B, Saxena KK, Prasad DN. Study on anti-inflammatory activity in leaves of Nyctanthes arbortristis. Journal of Ethnopharmacology, 1984; 11: 319-330.
38. 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.
39. Sharma V, Pooja Marwaha A.Hypoglycemic activity of methanolic extract of Nyctanthusarbortristis Linn. root in alloxan induced diabetic rats. International Journal of Pharmacy and Pharmaceutical Sciences, 2011; 3(3): 210-212.
40. Rathee JS, Hassarajani SA, Chattopadhyay A.Antioxidant activity of Nyctanthusarbor-tristis leaf extract. Food chem, 2007; 103(4): 1350-1357.
41. Talakal TS, Dwivedi SK, Shamra SR. In vitro and in vivo antitrypanosomal potential of Nyctanthes arbor-tristis Pharmaceutical Biology, 2000; 38: 326- 329.