Original Article

Nyctanthus Arbor- Tritis Linn: A Sacred Plant For Adornment That Holds Extensive Medicinal Capabilities

Gopal Bharwad[1*], Mrs. Foram Mehta[2], Dr. Pragnesh Patani[3]

[1*]Student, Khyati College of Pharmacy, Palodia, Ahmedabad, Gujarat

[2]Associate Professor, Khyati College of Pharmacy, Palodia, Ahmedabad, Gujarat

[3]Principal, Khyati College of Pharmacy, Palodia, Ahmedabad, Gujarat

***Corresponding Author**- Gopal Bharwad
*Student, Khyati College of Pharmacy, Palodia, Ahmedabad, Gujarat
Email: gopalbharwad1707@gmail.com

1.Abstract:
One of India's most useful traditional medicinal plants is *Nyctanthes arbor-tristis* Linn. It is widespread throughout the sub-Himalayan region and Godavari. Because each component of the plant has some medicinal value, it can be used for commercial purposes. It is now regarded as a valuable source for a number of one-of-a-kind products used in the creation of medical treatments for a variety of diseases and industrial products. The present review emphasizes the necessity of further investigating the information that is available and includes comprehensive information on the chemical constituents, biological activities of important compounds, pharmacological actions, medicinal applications, and micro propagation of Night jasmine.

Keywords: *Nyctanthes arbor-tristis* L.'s biological activity, micropropagation, and therapeutic effects.

1. Introduction:

In the history of all civilizations, medicinal plants have been used to treat diseases. Because of their safe and effective active principles, medicinal and aromatic plants have garnered widespread interest [1-4]. One of the most versatile medicinal plants with a wide range of biological activities, *Nyctanthes arbor-tristis*, also known as "a night flowering sad tree," belongs to the family Oleaceae (Nyctaginaceae). It is widely cultivated in tropical and subtropical regions all over the world. It is a woody perennial that grows in the ground and can live for 5 to 20 years. It is typically a small tree or shrub with brilliant, highly fragrant flowers that appear at night and vanish before the sun rises, leaving the ground beneath a pleasing mix of red and white. Because of this, the plant is known as the "Tree of Sadness" (arbor-tristis) during the day. It is also referred to as Parijat, queen of the night, Harsinghar, Coral Jasmine, and night flowering jasmine [5]. The phenology of the night flowering jasmine helps the people of Tripura plan agroforestry activities and disaster prevention [6] by predicting weather and rainfall variations. Since antiquity [7,8] every part of the tree has been used as a household remedy for treating a variety of human ailments. The plant has the following names in various languages: Night jasmine in Kannada is called Parijatha. Parijatha in Bengali, Sephalika in Sanskrit, Pagadamalle in Telugu and in Hindi Parijathak, in Marathi and Parijatakam, in Malayalam Oriya & Gangasiuli, Jayaparvati in Gujarati.

2. Ecology & Distribution:

Nyctanthes arbor-tristis grows as undergrowth in dry deciduous forests and on rocky ground in dry hillsides in its native habitat. It originated in southern Asia and can be found all the way from Nepal and northern Pakistan to northern India and southeast Thailand. It tolerates moderate shade and grows at sea level up to 1500 meters above sea level in a wide range of seasonal and non-seasonal rainfall patterns. It is found in parts of Jammu and Kashmir, Nepal to the east of Assam, Bengal, Tripura, and the central region all the way up to Godavari in the south of India. Typically, flowering occurs between July and October. A semi-shady and isolated location is where Nyctanthes likes to grow [9].

2.1 Soil & climate:

This tree thrives in a wide range of loamy soils and typical garden soils with a pH between 5.6 and 7.5. The plant needs conditions that range from full sun to partial shade, and it needs to be watered frequently but not excessively [5].

2.2 Morphology:

The large shrub *Nyctanthes arbor-tristis* Linn has quadrangular branches and flaky, grey, rough bark8. It can reach a height of 10 meters. The leaves are simple, hairy, rough, decussately opposite, 6–12 cm long, and 2 - 6.5 cm in width with a full margin. The flowers frequently appear in groups of two to seven together [7] and are arranged at the terminal tips of branches or in the axils of leaves. These are sessile, fragrant, and have a companulate calyx. They also have a white corolla with 5-8 lobeds and an orange-red center. The stigma is obscurely bifid, and two stamens are inserted near the top of the corolla tube. Dewdrops sit on the snow-white petals, which are used for worship. The brown, flat, compressed, heart-to-round capsules that make up the fruit have two sections each containing one seed. The testa are thick, the seeds are exalbuminous, and the large, transparent cells' outer layer is heavily vascularized [8] The radicle is inferior and the cotyledons are flat.

2.3 Phytochemistry:

The presence of phytosterols, phenolics, tannins, flavonoids, glycosides, and saponins was discovered by phytochemical analysis of the seeds, fruit, and leaves of N. arbor-tristis (Table 1). The largest categories of chemicals produced by this plant are the secondary metabolites, such as glycosides and alkaloids [10,11]. Iridoid glycosides and phenylpropanoid glycosides are the glycosides [12,13,14]. From the seeds, the iridoid glucosides arbortristosides A, B, D, and E have been isolated [15,16,17]. These have antileishmanial and immunomodulatory properties [18]. Desrhamnosylverbascoside, 6,7-di-0-benzoylnyctanthoside, 6-0-trans-cinnamoyl- 6,-hydroxyloganin, and 7-0-transcinnamoyl-6b-hydroxyloganin are iridoid glycosides found in the leaves and have anti-inflammatory and antipyretic properties [12]. E-sitosterol, a novel glycoside known as naringenin-4’-0-e-glucopyranosy l-Z-xylopyranoside22, was isolated and identified through phytochemical analysis of the stem of N. arbor-tristis. Its seeds contained nyctoside-A [23], a water-soluble phenyl propanoid glycoside. Rengyolone, a cyclohexylethanoid, and 6-0-trans-cinnamoyl, one of the iridoid [24] glucosides An ethanolic extract of the flowers was used to isolate -7-0-acetyl-6-hydroxyloganin, arborside C, 6-hydroxyloganin, and nyctanthoside, a phenylpropanoid glycoside. Rats [25] have also been shown to benefit from the diuretic effects of Nyctanthes arbor-tristis hot flower infusion. Flowers have altered anthocyanins, the diterpenoid nyctanthin, flavonoids, and an essential oil that is similar to jasmine. The flowers' chloroform extract has yielded 4-hydroxy hexahydrobenzofuran-7-one. [13] Carotenoids are found in the flower's orange tubular calyx [26]. An alkaloid named nyctanthine is additionally found in leaves of Nyctanthes arbor-tristis. Mannitol, an astringent, resinous substance, ascorbic acid, sugar, coloring, traces of an oily substance, tannic acid, methyl salicylate, carotene, an amorphous resin, and traces of volatile oil are also found in the leaves. The glucosides of linoleic, oleic, lignoceric, stearic, palmitic acid, and b-sitosterozl—linoleic, oleic, and b-sitosterozl—that make up the pale yellow-brown fixed oil come from the seed kernels, which produce between 12 and 16 percent of the oil. Nyctanthic acid, a tetracyclic triterpenoid acid, is deposited after several weeks of storage at 0°C [9]. Flowers and roots

have also yielded some essential oils, coloring (nyctanthin), mannitol, tannin, and glucose [7, 28, 29]. One glycoside and two alkaloids, one of which dissolves in chloroform and the other in water, are found in the bark. In small doses, the glycoside increases the amplitude of the frog's heart, but in large doses, it decreases the diastolic period until the heart stops due to an A-V block. -sitosterol and oleanolic acid were also found in Nyctanthesi callus extracts, and their effects on oesophageal ciliary motility were not observed with the chloroform-soluble alkaloid [9].

3. **The various components of Night jasmine and their therapeutic applications:**
Crude extracts and their various fractions from leaf, bark, root, seed, and oil have been used to demonstrate N. arbor-tristis's biological activity [46,47,48]. Traditional medicine has relied on crude extracts of various parts of N. arbor-tristis to treat a variety of ailments. Utilization of various parts of N. arbor-tristis has been prescribed since antiquity in the Ayurvedic, Siddha, and Unani medical systems [29,49,50]. Tonic, laxative, diaphoretic, and diuretic [7,51], digestive, antidote to reptile venom, and digestive juice [7,51] The enlargement of the spleen can also be treated with leaves. The powdered stem bark has traditionally been administered for rheumatic joint pain, malaria treatment, and as an expectorant [52,53]. The plant has been examined for its antihistaminic, CNS activities (such as hypnotic, tranquilizing, and anesthetic), analgesic, anti-inflammatory, antipyretic, antiulcer, and amoebicidal properties antidepressant, antitrypanosomal, antiviral, and immunomodulatory properties8, 54. The flowers are used as an astringent, ophthalmic, stomachic, and carminative, and they have a bitter taste. Coral jasmine is additionally used to treat nervousness, anxiety, migraine, gastritis, hepatitis, the runs, dizziness and dysmenorrhoea. Table 2 provides a summary of some of the plant parts' medicinal properties. However, Nyctanthes arbor-tristis's biological and pharmacological activities have been the subject of numerous reports based on contemporary scientific investigation55, in addition to these uses.

3.1 Antioxidant activity: Recent research has demonstrated that Nyctanthes arbor-tristis's stem and leaves could be a source of natural antioxidants39. The ethanolic extract of the leaves and stems of Nyctanthes arbor-tristis contained flavonoids, tannins, saponins, glycosides, alkaloids, steroids, and phenolic compounds, according to a phytochemical analysis. Phenolic compounds have been shown to have medicinal and physiological properties, as well as antioxidant properties that act as free radical terminators56,57. functions58. Nyctanthes arbor-tristis' encouraging performance in a variety of in vitro antioxidant tests demonstrated the plant's effectiveness as a scavenger of hydrogen peroxide and free radicals as well as a reducing agent. The polyphenolic and other phytochemical components of Nyctanthes arbor-tristis might be responsible for the plant's overall antioxidant activity37.

3.2 Anti-inflammatory, antipyretic, and antinociceptive properties: The anti-inflammatory properties of the leaves of Harsingar support its use by Ayurvedic practitioners for a variety of inflammatory conditions59. Carrageenin, formalin, histamine, 5-hydroxytryptamine, and hyaluronidase—all phlogistic agents—caused acute inflammatory oedema in rats, and the water-soluble fraction of the ethanol extract had significant anti-inflammatory effects32,60. Turpentine oil-induced acute inflammatory swelling in the knee joint of rats was significantly reduced by the extract32. The mouse also demonstrated anti-inflammatory effects from the leaf and fruit extracts. Both the isolated carotenoid (200 mg/kg) and the ethanolic extract of the orange tubular calyx of Nyctanthes arbor-tristis exhibited significant inhibition of when compared to the standard drug (Diclofenac sodium) and the untreated control, carragenan-induced rat paw edema26. When tested for its analgesic, antipyretic, and ulcerogenic properties, the water-soluble portion of an ethanol extract of the leaves showed significant aspirin-like antinociceptive activity but failed to produce morphine-like analgesia. The extract prevented brewer's yeast-induced pyrexia in rats by acting as an antipyretic, and when taken orally for six days, it caused dose-dependent gastric ulcers36,61.

3.3 Antimicrobial properties: Oil extracted from the bark, seeds, and leaves has a wide range of antibacterial properties against gram-negative and gram-positive bacteria, including strains of streptomyces. The mature leaf extracts of methanol and water The bactericidal properties of N. arbor-tristis against Staphylococcus aureus, Bacillus subtilis, Escherichia coli, and Pseudomonas aeruginosa were investigated. With the exception of P. aeruginosa, which was resistant to the aqueous extract62,64, both extracts were effective against the bacteria. The aqueous extract was generally less active than the methanol extract. Gram positive bacteria (B. subtilis, B. cerues, and B. megaterium) S. aureus, Streptococcus sp., and S. lutea).

3.4 Immunosuppressive activity: Gram extensively studied for their immunomodulatory properties35 their potential . Leaf with water negative (E. coli, Shigella dysentriae, Shigella shiga, Shigella boydii, and Pseudomonas sonnei). It has been discovered that an extract of Nyctanthes arbor-tristis a potent immunomodulator62, as demonstrated by responses from cells and the environment43,63. In mice, the 50% ethanolic extracts of N. arbor-tristis's seed and root also demonstrated immunomodulatory activity against systemic candidiasis. Both of the iridoid glucosides that were isolated from the seeds, arbortristosides A and C (5 mg/kg), were protective, with arbortristoside C being more effective than arbortristoside A in both protection and cure. While arbortristoside C had negative effects on the mice, prophylactic and therapeutic administration of arbortristoside A (5 mg/kg) increased protection. Both humoral and delayed type hypersensitivity responses to sheep red blood cells, as well as the macrophage migration index, were significantly boosted by the extracts and arbortristosides A and C in Balb/c mice42. By activating the cell-mediated immune system, flowers have also been shown to possess immunostimulant activity43. chloroform and ethyl acetate extracts of N. arbor-tristis flowers65 inhibited the aeruginosa) bacteria, but not the petroleum ether extract. In vitro antimicrobial activity against Staphylococcus aureus, Micrococcus luteus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Candida albicans, and Aspergillus niger44,66 has also been tested on the plant's stem bark extracts.

3.5 Antiviral Activity: The ethanolic extract, n-butanol fractions, and two pure compounds, arbortristoside A and arbortristoside C, that were isolated from N. arbortristis, inhibited the encephalomyocarditis virus (EMCV) and the Semliki forest virus (SFV) significantly. The ethanolic extract and the n-butanol fraction prevented EMCV and SFV infection in infected mice by 40 and 60 percent, respectively,15,67. Iridoid glucosides, arbortristosides A, B, and C, and Iridoid glucosides, arbortristosides A, B, and C.

4.6 Anti-leishmanial activity: N. arbor-tristis have been implicated in the 6-b-hydroxyloganin37. In macrophage cultures and hamster test systems, respectively, the arbortristosides A, B, C, and 6-beta-hydroxy-loganin demonstrated both in vitro and in vivo antileishmanial activity against amastigotes22,68. Antiplasmodial activity: In vitro antiplasmodial activity against Plasmodium falciparum (K1, multidrug resistant strain) was demonstrated by Rengyolone, a cyclohexylethanoid that was isolated from the ethanolic extract of Nyctanthes arbor-tristis flowers and its acetate. In addition, the extract was effective against Leishmania donovani and Entamoeba histolytica69 in vitro.

4.7 Sedative Activity: Rats were used to test the hot flower infusion's sedative potential25. Female rats were unaffected by this test, whereas male rats displayed a dose-dependent conscious sedative effect. Even at the highest dose, there was no change in blood glucose levels or in muscle strength or coordination at these doses. However, there was a significant decrease in glucose absorption from the small intestine. The extract's antioxidant and membrane stabilizing properties were partly responsible for the sedation.

4.8 Anti-allergy Activity: A water-soluble portion of the alcoholic extract of N. arbor-tristis leaves was used to protect guinea pigs from asphyxia before they were exposed to histamine aerosol70. It was discovered that N. arbor-tristis's arbortristosides A and C were anti-allergic37.

4.9 Hepatoprotective Activity: It was discovered that the aqueous extracts of the leaves and seeds of Nyctanthes arbor-tristis had antihepatotoxic activity against the hepatotoxicity induced by carbon tetrachloride (CCl4)71,72. By lowering the levels of serum bilirubin (total and direct), serum SGPT (serum glutamic pyruvic transaminase), and serum SGOT (serum glutamic oxaloacetic transaminase), it was also established that the alcoholic and aqueous extracts had significant hepatoprotective activity34. Histopathological examinations of liver samples provided evidence of the extracts' ability to regenerate hepatocytes, corroborating the findings.

5. Night jasmine clinical studies and potential medicinal uses:

Although numerous studies on the various biological activities of Night jasmine extracts have been conducted, only a few reports on clinical studies with the extracts or compounds and their medicinal applications7,9,28,29,51,73 are available.

- When treating piles, patients should also use seeds internally and apply fresh paste made from crushed seeds to the piles. When treating piles, it is recommended to apply one seed daily with water.
- The leaf juice mixed with honey is taken internally to treat dry cough.
- The aqueous paste of leaves is used externally to treat skin conditions, particularly ring worm. Skin conditions are treated with a unique herbal oil made by boiling fresh leaves in mustard oil.
- For the treatment of intestinal worms, the leaf juice mixed with common salt and honey is typically administered to children.
- Nyctanthes arbor-tristis's young leaves are used as a female tonic. Three fresh Night jasmine leaves and five Black Pepper seeds are suggested for patients with gynecological issues.
- The juice of the leaves can be used as a laxative, cholagogue, and mildly bitter tonic.
- In the treatment of chronic fevers, leaf juice is combined with other herbs like ginger, basil, clove, mint, pippali, and vasa to make a safe purgative for infants.
- The decoction made from the seeds of Nyctanthes arbor-tristis is used as a hair tonic and to get rid of lice and dandruff.
- Nyctanthes arbor-tristis L flowers are used in a decoction for up to a week during an attack to treat gout.
- The plant's bark is expectorant. To encourage the expectoration of thick phlegm, approximately five grains of the bark are consumed with the betel nut and leaf.
- Fever, malaria, and blood dysentery can all be treated with leaf decoction, which is taken twice daily with honey.

6. Applications for products obtained from The arbor-tristis Nyctanthes:

Nyctanthes arbor-tristis has been utilized in traditional fabric dyeing as a dyestuff or tannin. The flowers' saffron-yellow corolla tubes are bright orange. Nyctanthin, a colorant that was once used to dye silk, sometimes in conjunction with turmeric (Curcuma longa L.), indigo (Indigofera spp.), and safflower (Carthamus tinctorius L.). Additionally, the dye is utilized locally for the dyeing of cotton cloth and as a low-cost alternative to saffron for the coloring of Buddhist priest robes. Fabrics are submerged in a decoction of corolla tubes9 for dyeing. Like saffron, it gives off a beautiful orange, yellow, or golden color, but it quickly fades in the sun and can be easily washed out. Lime juice or alum is added to the dye bath to make the color last longer. This makes it moderately resistant to light, soap, alkali, and acid. The leaves are sometimes used to polish wood and ivory, and the bark can be used to tan.

Essential oils: The perfume is made from the essential oil of the fragrant flowers, which is similar to the oil of jasmine9. Boarding is sometimes made from timber. The brown, close-grained, moderately

hardwood has an average density of 80 kg/m and is fairly heavy. Baskets are made from young branches9.
Fuel: Sometimes, the wood is used as firewood. Support, boundary, or barrier: It is planted in hedges as well.

7. Nyctanthes arbor-tristis's toxic effects:

Rats69,74 have been used to investigate the toxic effects of an ethanolic extract of Nyctanthes arbor-tristis leaf extract. The water-soluble portion of the alcoholic extract of the leaves has been found to have a median lethal dose (LD50) of 16 gm/kg in rats. At 2.0 gm/kg, there was no mortality, while at 32 gm/kg, 75% mortality was observed32. Rats develop gastric ulcers when they are given ethanol extract of the leaves orally (1, 2 or 4 gm/kg/day) for six days in a row36. This extract also caused irritation because it, dose-dependently, produced unformed semi-fluid collagenous pasty stools in albino mice, caused conjunctival congestion with oedema when injected into the rabbit's eye, and caused vesicles on both palms in the person who ground the dried leaves69.

8. Management and propagation:

Night jasmine seeds or semi-hardwood cuttings can easily spread. It quickly coppices and isSpleen enlargement is treated with root decoction. not scavenged by cattle or goats. April-sown seedlings are transplanted in May and June. By August, it has reached a height of 2 meters, and flowering begins in September or October of the same year. The potted-grown rooted cuttings also produce flowers. To keep the desirable variants chosen from a large plant population, clonal propagation through cutting or grafting becomes necessary. Budding75 has been used to propagate numerous National Botanical Research Institute, Lucknow selections. For proliferation through seeds, the seed goes to be dried on plants to eliminate and gather seeds. Due to poor germination and the death of many young seedlings under natural conditions, propagation from seeds is unreliable9. As a result, efforts must be directed toward propagating this plant using alternative methods like tissue culture.

9. Studies of micropropagation:

Night jasmine has been regenerated directly from nodal explants, indirectly from cotyledons, leaf, internode, and nodal explants taken from one-month-old seedlings, and from Nyctanthes arbor-tristis mature trees. On 2,4-D (2 mg/l) and GA3 (2 mg/l) alone, as well as on medium supplemented with combinations of 2,4-D (0.5 mg/l) and kinetin (0.5 mg/l), the highest percentage of callus induction was observed in cotyledonary explants taken from mature green seeds. 2,4-D (0.5 mg/l) remains in internodal and nodal explants. + Compared to other combinations of growth regulators, it has been found that + kinetin (0.5 mg/l) is better at promoting the formation of calluses. In terms of callus induction and growth, explants taken from one-month-old seedlings performed better than those taken from mature trees. In terms of callus induction, growth, and differentiation, the cotyledonary and leaf explants out of the four used were found to be superior to the internodal and nodal explants.
However, only the calli from cotyledonary explants showed evidence of shoot formation upon subculturing with BAP (1.0 and 2.0 mg/l) + GA3 (2 mg/l). On 1 mg/l BAP alone and 2 mg/l BAP+2 mg/l GA3, direct regeneration of multiple shoots from nodal segments of mature trees and seedlings was achieved76. N. arbor-tristis L. appears to rapidly multiply through in vitro axillary shoot proliferation and growth, followed by successful ex vitro establishment of regenerated plants77, according to available reports. A plant regeneration that is effective, quick, and repeatable.
This study developed a protocol for N. arbor-tristis using cotyledonary node explants taken from aseptic seedlings 15 days old. Maximum shoot induction was achieved by supplementing MS medium with the two cytokines TDZ (1.0 M) and BA (2.5 M). The combination of BA and NAA significantly increased shoot multiplication. By the end of the fourth subculture passage, the regenerated shoots had significantly increased their multiplication and length when subcultured in hormone-free MS medium. The basal cut ends of the regenerated shoots were submerged for 30 minutes in 200 M IBA before being transplanted into sterile soil rite-filled plastic pots to produce shoots. With a 85% survival

rate, the plantlets with well-developed shoots and roots were grown in greenhouses and successfully established in earthen pots filled with garden soil. MS basal medium supplemented with 1.0–1.5 mg/l 6-benzyladenine (BA), 50 mg/l adenine sulfate (Ads), and 3% (m/v) sucrose was used in an alternative method for in vitro clonal propagation of Nyctanthes arbor-tristis78. In addition to BA + Ads, adding indole-3-acetic acid (IAA) to the culture medium increased the rate of shoot multiplication. After four weeks of culture, the MS medium with 1.5 mg/l BA, 50 mg/l Ads, and 0.1 mg/l IAA reached the maximum mean number of microshoots per explant (6.65). On 12 strength MS medium supplemented with either indole-3-butyric acid (IBA), IAA, or naphthylacetic acid (NAA) and 2% sucrose, the elongated shoots rooted within 13 to 14 days. On a medium containing 2% sucrose, 0.25 mg/l IBA, and 0.1 mg/l IAA, the highest rooting percentage was observed. The soil conditions in which the in vitro-raised plants could be grown normally.

10. Conclusion and outlook for the future:

The valuable medicinal plant Nyctanthes arbor-tristis is a one-of-a-kind source of useful metabolites like alkaloids, phytosterols, phenolics, tannins, flavonoids, glycosides, and saponins. Even though crude extracts from various parts of Nyctanthes arbor-tristis have been shown to have medicinal uses since ancient times, more recent pharmaceuticals can be made after thorough research into the bioactivity, mechanism of action, pharmacotherapeutics, and toxicity of the compound, as well as proper standardization and clinical trials. In point of fact, the time has come to utilize the centuries-old understanding of Nyctanthes arbor-tritis through contemporary drug development methods. Research on Nyctanthes arbor-tristis has received more attention in recent years. Numerous pharmaceutically and industrially useful preparations and compounds have also been put on the market, which provides scientists with sufficient motivation to investigate this medicinal plant further. However, there is still a lot of work to be done on this plant's biotechnological aspects. Domestic cultivation can be a viable alternative, and it may be able to overcome the issues that are prevalent in herbal extracts, such as misidentification, genetic and phenotypic variability, extract variability and instability, toxic components, and contaminants, since drug preparation from the wild results in the loss of genetic diversity and habitat destruction. Controlled growth systems also make it possible to consider manipulating phenotypic variation in the concentration of medicinally important compounds present at harvest with the goal of increasing potency, reducing toxin levels, and increasing uniformity and predictability of extracts79. However, the use of controlled environments via cell and tissue culture can overcome difficulties associated with cultivation and may be a means to manipulate phenotypic variation in bioactive compounds and toxins. Tissue culture and genetic transformation techniques have made significant progress in altering pathways for the biosynthesis of target metabolites in various medicinal plants; however, no efforts have been made to do so in Night jasmine. In this species, direct DNA sequence manipulations to alter gene expression and pathway modification may also be ripe for expansion; the active compound content may be a potential target for trait manipulation. Further molecular marker-assisted selection has the potential to identify desirable genotypes at an early stage and to enhance agronomic and medicinal traits. The method is based on finding particular DNA sequences that are closely related to the traits of interest. Molecular markers can also be used to study the diversity of a species' available germplasm. However, no molecular marker-based approaches to studying genetic diversity or plant improvement in Night jasmine have been reported to date.

11. References:

1. Chopra RN, Nayer SL & Chopra IC, *Glossary of Indian Medicinal Plants*, (PID, CSIR, New Delhi), 1956.
2. Chopra RN, Chopra IC, Handa KL & Kapur LD, *Indigenous Drugs of India*, (Academic Publishers, Calcutta, India), 1958, 51–595.
3. Kirtikar KR & Basu BD, *Nyctanthes arbor-tristis in medicinal plants*, edited by Blatter E, Cains JF, Mhaskar KS, (LM Basu Publishers, Allahabad, India), 1935, 536.

4. Chatterjee A & Parkrashi S, *The Treatise on Indian Medicinal Plants*, Vol. 3, (Publications and Information Directorate, New Delhi, India), 1994, 76.
5. Kiew R & Baas P, *Nyctanthes* is a member of Oleaceae, *Proc Indian Acad Sci* (Plant Sc.), 93(3) (1984) 349-358.
6. Acharya S, Prediction of rainfall variation through flowering phenology of night-flowering jasmine (*Nyctanthes arbor-tristis* L.) in Tripura, *Indian J Tradit Knowle*, 10 (2011) 96-101.
7. Kirtikar KR & Basu BD, Indian Medicinal Plants, Vol. VII, (LM Basu Publishers, Allahabad, India), 2110-2113.
8. Sasmal D, Das S & Basu SP, Phytoconstituents and therapeutic potential of *Nyctanthes arbor-tristis* Linn., *Pharmacog Rev*, 1 (2) (2007) 344-349.
9. Anonymous, The *Wealth of India*: A Dictionary of Indian Raw Materials and Industrial Products, Vol. VII, (National Institute of Science Communication, CSIR, New Delhi), 1997, 69-70.
10. Dhingra VK, Seshadri TR & Mukerjee SK, Carotenoid glycosides of *Nyctanthes arbor-tristis* Linn., *Ind J Chem*, 14B (1976) 231.
11. Kapoor LD, Kapoor SL, Srivastava SN, Singh A & Sharma PC, Survey of Indian plants for saponins, alkaloids and flavonoids, II, *Lloydia*, 34 (1971) 94.
12. Tuntiwachwuttikul P, Rayanil K & Taylor WC, Chemical Constituents from the flowers of *Nyctanthes arbor-tristis*, *Science Asia*, 29 (2003) 21-30.
13. Khatune NA, Islam ME, Abdur Rahman MA, Mosaddik MA & Haque ME, *In-vivo* cytotoxic evaluaton of a new benzofuran derivative isolated from *Nyctanthes arbor-tristis* L. on ehrlich ascite carcinoma cells (EAC) in mice, *J Med Sci*, 3 (2) (2003) 169-173.
14. Patra A, Mathur V & Kundu AB, A phenyl propanoid glycoside from *Nyctanthes arbor-tristis* Linn., *J Ind Chem Soc*, 74 (8) (1997) 653-655.
15. Rathore A, Srivastava V, Srivastava KC & Tandon JS, Iridoid glucosides from *Nyctanthes arbor-tristis*, *Phytochemistry*, 29 (6) (1990) 1917-1920.
16. Mathuram V & Kundu AB, A reinvestigation of the structures of arbortristosides A and B from *Nyctanthes arbor-tristis*, *J Nat Prod*, 54 (1) (1991) 257-260.
17. Purushothaman KK, Venkatanarasimhan M & Sarada A, Arbortristoside A and B, two iridoid glucosides from *Nyctanthes arbor-tristis*, *Phytochemistry*, 24 (4) (1985) 113-176.
18. Banerjee A, Poddar A, Ghanta S, Chakraborty A & Chattopadhyay S, *Nyctanthes arbor-tristis* Linn. – Spectrum of its bioactivity potential, *Planta Med*, 73(9) (2007) 805-805.
19. Stuppner H, Muller EP, Mathuram V & Kundu AB, Iridoid Glycosides from *Nyctanthes arbor-tristis*, *Phytochemistry*, 32 (2) (1993) 375-378.
20. Srivastava V, Rathore A, Ali SM & Tandon JS, New benzoic esters of loganin and 6-β-hydroxyloganin from *Nyctanthes arbor-tristis*, *J Nat Prod*, 53 (2) (1990) 303-308.
21. Venkatanarasimhan M, Kundu AB, Banerjee S & Patra A, Occurrence of two new esters of 6-β-hydroxyloganin from *Nyctanthes arbor-tristis*, *J Ind Chem Soc*, 68 (10) (1991) 581-584.
22. Tandon JS, Srivastava V & Guru PY, A new class of leishmanicidal agents from *Nyctanthes arbor-tristis*, *J Nat Prod*, 54 (4) (1991) 1102-04.
23. Mathuram V, Patra A & Kundu AB, A Phenyl propanoid glycoside from *Nyctanthes arbor-tristis*, *J Ind Chem Soc*, 74 (1997) 653-55.
24. Singh BR, Structural study of water soluble gluco-mannan from
25. *Nyctanthes arbor-tristis* seeds, *Pol J Chem*, 65 (2-30) (1991) 353-359.