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COMPREHENSIVE REVIEW OF NYCTANTHES ARBORTRISTIS (HARSHRINGAR): PHARMACOGNOSTIC INSIGHTS, TRADITIONAL USES, PHYTOCHEMICAL COMPOSITION, AND MEDICINAL APPLICATIONS

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ABSTRACT

Nyctanthes arbortristis, a member of the Oleaceae family, is a significant medicinal large shrub commonly recognized as 'Harshringar,' 'Parijat,' and 'Night jasmine.' India boasts a remarkable diversity of medicinal plants, and this shrub is predominantly cultivated in tropical and subtropical regions across the globe. Nyctanthes arbortristis, known for its ornamental appeal, offers medicinal value throughout its various parts, making it a versatile plant. Throughout history, this plant and its extracts have been used to treat a variety of ailments, earning it a well-deserved reputation as a valuable resource for medicinal and industrial applications. This review aims to provide a comprehensive understanding of Nyctanthes arbortristis, encompassing pharmacognostic descriptions, traditional uses, extraction methods, chemical constituents in its different parts (leaves, flowers, seeds, bark, stem, and roots), phytochemical assessments, properties, and medicinal applications. The therapeutic attributes of the plant are attributed to a wide range of phytoconstituents, including steroids, tannins, alkaloids, glycosides, flavonoids, and various other components, each contributing to a multitude of pharmacological activities. This article offers a comprehensive and informative overview of Nyctanthes arbortristis.

Keywords: *Nyctanthes arbortristis*, ethnobotanical description, phytochemical profile, healing potential.

INTRODUCTION

India boasts a rich diversity of medicinal plants, which have been integral to traditional healing practices for centuries. This ancient knowledge has contributed significantly to the development of essential drugs in modern medicine.[1]

Nyctanthes arbortristis (NAT), an indigenous Indian medicinal herb, stands out as a plant with a long history of medicinal utility. It is a staple in traditional Indian medicine and holds a revered place in the herbal pharmacopeia. Nyctanthes arbortristis belongs to the Oleaceae family and is known by various names such as Night jasmine, Harsinghar, and Parijat. The genus name "Nyctanthes" is derived from the Greek words 'Nykhta,' meaning night, and 'anthos,' meaning flower. It is primarily found in the sub-Himalayan region and is often cultivated as an ornamental plant in Indian gardens.[2]

Different parts of the NAT plant, including seeds, leaves, flowers, bark, stem, roots, and fruits, exhibit substantial pharmacological activity and have been harnessed for local and traditional medicinal purposes. The plant is enriched with bioactive compounds such as tannins, glycosides, alkaloids, carbohydrates, terpenoids, steroids, flavonoids, and more, each contributing to diverse physiological functions.[3]

Tribal communities have a history of using Nyctanthes arbortristis to treat a range of ailments, and it has gained recognition as a valuable source for diverse medicinal and industrial applications. The plant demonstrates a broad spectrum of therapeutic properties, encompassing anti-inflammatory, antipyretic, analgesic, antihistaminic, antibacterial, antidepressant, antiviral, anticancer, antioxidant, antiarthritic, antiparasitic, antifungal, antidiabetic, antimalarial effects, and more.[2]

This review provides a comprehensive overview, encompassing geographical, botanical, and ethnobotanical aspects, as well as in-depth information on the plant's chemical constituents, extraction methods, biological activities of key compounds, pharmacological actions, and medicinal applications of Nyctanthes arbortristis.

HARSHRINGAR UNVEILED: A GEOGRAPHICAL AND BOTANICAL ODYSSRY

Habitat:- Nyctanthes arbortristis (NAT) thrives in a variety of loamy soils, often found on rocky terrain. It demonstrates a moderate tolerance for shade and frequently grows as undergrowth in dry deciduous forests. Its natural habitat extends from sea level to altitudes of up to 1500 meters, adapting to a wide range of rainfall patterns, from seasonal to non-seasonal. The plant's pleasant fragrance has made it a common choice for cultivation in gardens.[4,5]

Climate and Soil Preferences:- NAT flourishes in arid and semi-arid climatic conditions, with red and black soils featuring a pH range of 5.6-7.5 providing an ideal environment for its growth.[6] Flowering in Nyctanthes arbortristis typically occurs between July and October. This plant's requirements include exposure to both full sunlight and partial shade, along with regular watering without the need for excessive moisture.[7]

Geographical Distribution:- Nyctanthes arbortristis is primarily found in the outer Himalayan region, spanning across Jammu and Kashmir, Nepal, Assam, Bengal, and Tripura, extending through the central region down to the Godavari in the south.[8] Its distribution reaches from northern Pakistan and southern Nepal to northern India, encompassing the southern regions of Thailand.[9]

Cultivation: - Currently, Nyctanthes arbortristis is widely cultivated in tropical and subtropical regions. The genus Nycthanthes comprises two species, N. arbortristis native to India, and N. aculeata native to Thailand, where the former holds a sacred significance in religious ceremonies.[10]

Plant Type:-Nyctanthes arbortristis is a small tree or shrub classified as a terrestrial woody perennial plant. It belongs to the Tracheophyte group and is a member of the Magnoliopsida or Dicotyledonae class.[11]

Size and Bark:- NAT is a deciduous tree that reaches heights of up to 10 meters, featuring quadrangular branches with grey or greenish-white rough bark. It's often referred to as "the sad tree" or "tree of sorrow" due to its flowers losing brightness during the daytime, typically blooming in the afternoon and evening. The plant has a typical lifespan of 5-20 years.[12,13]

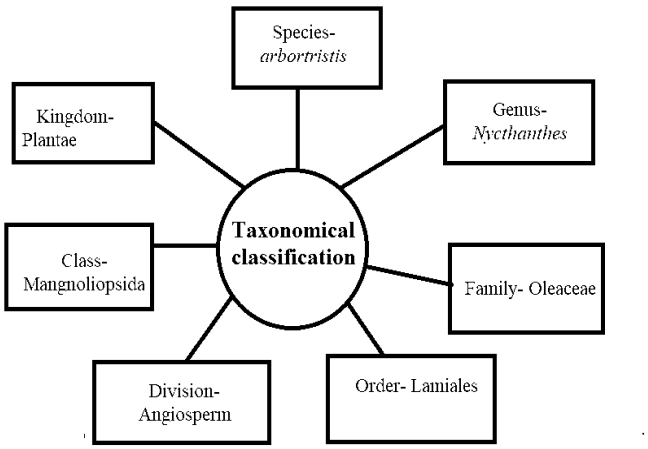
Leaves:-The leaves are short, opposite, measuring 5-10 by 2.5-6.3 cm, ovate, and acute, with distant, bulbous hairs. They are simple, petiolate, exstipulate, and have acute and ovate lamina. The margin is entire, with a dark green upper surface containing dotted glands and a softly pubescent pale green lower surface. The venation is unicostate and reticulate, and the petioles are long with axial concavity.[14,15]

Flowers:- Nyctanthes arbortristis produces small, fragrant, and slender white flowers with lobes measuring 5-15 mm in length. They exhibit axillary or terminal placentation and imbricate aestivation. The bracts are broadly ovate (6-10 mm long and hairy), while the calyx is narrowly campanulate (6-8 mm long). The corolla has a cylindrical shape at the center with two stamens at its top.[16]

Fruits and Seeds:- The plant's fruits are flat brown capsules with a heart shape, approximately 2 cm in diameter, each containing a single seed. The seeds are compressed, exalbuminous, and have a thick testa. The outer layer of the seed is large, transparent, and heavily vascularized.[17]

Bark and Stem: -Nyctanthes arbortristis has rough and firm bark, often grey or brown in color, featuring a scaled and patchy surface due to the shedding of circular barks and grey-brown regions. The linear bark exhibits both soft, collapsed, and non-collapsed phloem, characterized by a creamy and white color.[15]

TAXONOMICAL CLASSIFICATION [18]



INDIGENOUS LABELS: NAT FOLK NICKNAMES

Nyctanthes arbortristis, known by a multitude of names across various languages and regions, includes "Night Jasmine" and "Coral Jasmine" in English. In Hindi, it is recognized as "Harsingar," "Seoli," "Nibari," "Sihau," and "Shefali." In Sanskrit, it bears the names "Parijata," "Parijatah," and "Sephalika." Bengali speakers refer to it as "Seephalika," "Seoli," and "Harsinghar." In Gujarat, it is known as "Jayaparvati" and "Parijatak," while in Punjabi, it goes by "Harsinghar." In Tamil, it is identified as "Manjhapu" and "Pavala-Malligai," and in Oriya, you may hear "Godokodiko," "Gunjoseyoli," and "Singaraharo." Telugu names encompass "Kapilanagadustu," "Pagadamalle," "Sepati," and "Parijat," while in Kannada, it is referred to as "Goli,"

"Harsing," and "Parijata." These diverse names underscore the plant's wide recognition and cultural significance across regions.[19]

FLORAL FOLKLORE: NAT ETHNOBOTANICAL CHARM

Nyctanthes arbortristis, commonly known as NAT, holds a revered place in traditional medicine and is employed using diverse extraction methods. The leaves are utilized in the Caribbean for external treatments of ringworm, intestinal worms, and dry cough, while their juice aids digestion and serves as a snakebite antidote. The leaves also feature in remedies for fever, cough, malaria, blood dysentery, and diabetes, offering a range of medicinal properties. NAT flowers play a role in silk dying and offer stomachic, expectorant, and astringent properties. They are also applied in the treatment of piles, gout, and skin issues. The roots are traditionally anthelmintic and used for spleen enlargement, while seeds address bilious fevers and various ailments. The stem and bark find applications in joint pain relief, malaria treatment, and eye pain remedies. These traditional uses underscore the plant's versatility and importance in various cultural practices.[20-22]

COMPRESSIVE PHYTOCHEMICAL PROFILE OF NAT

Nyctanthes arbortristis, or NAT, contains a diverse array of phytoconstituents belonging to various chemical classes, including steroids, terpenes, alkaloids, glycosides, and flavonoids. Notably, alkaloids and glycosides constitute the major chemical groups produced by this plant. The root part of NAT contains alkaloids, tannins, and glucosides. In specific, from the chloroform extract of the root, compounds like β-sitosterol and oleanolic acid have been isolated.[20,23,24]

Phytoconstituents from *Nycthanthes arbortristis*

Chemical Class	Leaves	Stem and Bark	Flower	Seed
Steroids	β-sitosterol	β-sitosterol	Stigmasterol	β-sitosterol
Terpenes	Triterpenes-β-amyrin, oleanolic acid, Friedeline, lupeol.	β-amyrin, 21α-Hydroxyfriedal-4-(23)-en-3-one, friedal-1-ene-3-one, oleanolic acid, nyctantic acid.	α-pinene, diterpene-Nyctanthin p-cymene,	Triterpenes-3, 4-secotriterpene acid, nyctanthic acid.
Alkaloids and Glycosides	Nyctanthine, Flavonol-Glycosides-astragaline, Nicotiflorine, Irridoid glycosides-arborsides A,B,C, 6β-hydroxyloganin, Desrhamnosylverbacoside, 6,7-Di-O-benzoylnycthanoside,	Naringenin-4′-O-β-glucopyranosyl-α-xylopyranoside, Arbortristoside-A, Nyctoside-A, 6-β-hydroxyloganin	2-phenylethyl-β-D-glucopyranoside, n-tetradecyl-β-D-glucopyranoside, Irridoid glycosides-6-O-trans-cinnamoyl-7-O-acetyl-6-β-hydroxy loganin, Arbortristoside C 6-β-hydroxy loganin, Nyctanthoside, Monogentiobioside-	Phenyl propanoid glycoside-Nyctoside A, Irridoid glycosides-arbortristosides A,B,C,D and E.

	6-O-transcinnamoyl-6β-hydroxyloganin, 7-O-trans-cinnamoyl-6β-hydroxyloganin.		β-D, B-digentiobioside Cardiac glycoside-nymphalin.	
Flavonoids	Nicotiflorin		Quercetin, Kaemferol, Apigenin, Anthocyanin.	
Miscellaneous	Mannitol, Tannic acid, Ascorbic acid, Methyl salicylate, Carotene, Glucose, Fructose, Volatile oil, Amorphous resin, Hexatriacontane, benzoic acid and Benzoic ester of loganin.	1-Triacontanol, Pelargonic acid, Lignoceric acid.	D-Mannitol, Tannin, Glucose, Essential oil, Carotenoids, Crocetin, Crocin, Rengylone.	Glycerides of linoleic, oleic, Lignoceric, Stearic, Palmitic acid, Myristic acid, Polysaccharide composed of D-Glucose and D-Mannose, a pale yellow brown oil.

Phytochemical Analysis and Physical Characteristics of NAT Leaves

In a detailed examination of various solvent extracts, tests revealed the presence of alkaloids in petroleum ether, aqueous, and ethanol extracts. Carbohydrates were consistently found in petroleum ether, aqueous, and ethanol extracts. Flavonoids were detected in aqueous, ethyl acetate, and chloroform extracts. Glycosides were present in petroleum ether, aqueous, ethanol, and ethyl acetate extracts. Terpenoids and steroids were confirmed in all extracts. Proteins and amino acids were identified in petroleum ether and aqueous extracts, with ethanol extracts showing reactivity. Tannins were detected in petroleum ether, aqueous, and ethanol extracts. Saponins were found in petroleum ether and aqueous extracts. Phenols were identified in all but the ethyl acetate extract. However, anthraquinone glycosides remained undetected in any of the solvent extracts.[25-28]

The phytochemical evaluation of Nycthanthes arbortristis leaves has revealed several crucial parameters that provide insights into their characteristics and potential applications. These leaves exhibit a dark green appearance, presenting as a viscous semi-solid substance. Their odor is indistinct, while their taste is characterized by bitterness and astringency. The moisture content of these leaves is notably high at 50.01%, suggesting their ability to retain water. The ash value, an indicator of the inorganic residue after incineration, stands at 13.98%, emphasizing the mineral composition of these leaves. An acid value of 76.27% signifies the presence of acidic components, while lignin content is measured at 15.87%. Additionally, the leaves contain 9.41% crude fiber, 2.10% fat, 15.20% protein, and 9.48% carbohydrate, emphasizing their nutritional profile. An iodine value of 134.44% indicates the degree of unsaturation in lipids present.[26-27]

Phytochemical Analysis and Physical Characteristics of NAT Bark

The phytochemical evaluation of Nyctanthes arbortristis bark revealed a diverse range of chemical constituents present in different solvent extracts. Alkaloids were detected through the Dragendroff and Mayer's tests in the chloroform and ethanol extracts, while steroids were identified via the Salkowaski and

Liebermann-Burchard tests in the petroleum ether and chloroform extracts. Triterpenes were confirmed using the Vanillin-Sulphuric acid test in the petroleum ether and chloroform extracts. Tannins and glycosides were prominent in the ethanol and aqueous extracts, as shown by the Ferric chloride, Dil. Nitric acid, and Keller Killani tests. Carbohydrates were detected in the aqueous extract using Molisch's and Fehling's tests. Additionally, flavonoids were present in the ethyl acetate and ethanol extracts, substantiated by the Shinoda and Lead acetate tests. However, saponins, proteins, and amino acids were not detected in any of the extracts, as indicated by negative results in the respective tests. This comprehensive analysis provides valuable insights into the chemical composition of Nyctanthes arbortristis bark, which can have significant implications for its potential medicinal and therapeutic uses.[29]

Nyctanthes arbortristis bark was evaluated for its phytochemical properties and quality parameters. The total ash content did not exceed 9.16% w/w, and the acid insoluble ash remained well below the limit at 0.30% w/w. The water-soluble extractive content met the requirement, not falling below 16.80% w/w. Additionally, the alcohol-soluble extractive content exceeded the minimum at 9.40% w/w. These findings underscore the high-quality phytochemical profile of Nyctanthes arbortristis bark, making it a valuable resource for various applications.[30]

Phytochemical Analysis and Physical Characteristics of NAT Flower

The phytochemical evaluation of Nyctanthes arbortristis flowers revealed a diverse array of chemical constituents in different solvent extracts. Notably, the presence of reducing sugars, alkaloids, tannins, cardiac glycosides, anthraquinone glycosides, proteins, terpenoids, and flavonoids was confirmed through various chemical tests in aqueous and alcohol extracts. However, saponins were found to exhibit foam formation exclusively in the aqueous extract. Surprisingly, no starch was detected in any of the solvent extracts. This concise analysis highlights the rich phytochemical composition of Nyctanthes arbortristis flowers, emphasizing their potential significance in traditional medicine and various applications.

The phytochemical properties of flowers, including ash values and extractive values, provide insights into their composition. Total ash should not exceed 3.3% w/w, with acid insoluble ash below 1.45% w/w and water soluble ash below 1.9% w/w. Extractive values indicate solubility, with water extractive not less than 22.5% w/w, alcohol extractive not exceeding 15.5% w/w, and chloroform extractive staying below 11.2% w/w. Flower petals and corolla tubes differ in some constituents: starch and mucilage are absent in both, tannin is only in the corolla tube, while cellulose, pectin, lignin, lipids, oils, and proteins are present in both. Calcium oxalate crystals are absent in petals but found in the corolla tube, and suberin is absent in both, contributing to their unique characteristics.[31]

Phytochemical Analysis and Physical Characteristics of NAT Fruit

The phytochemical evaluation of Nyctanthes arbortristis fruit unveils its chemical constituents and their reactions to different solvents. Alkaloids and glycosides are detected in the methanolic extract but are absent in the petroleum ether extract. Saponins, on the other hand, do not appear in either extract. Carbohydrates, flavonoids, and proteins with amino acids are prevalent in the methanolic extract, while they are notably absent in the petroleum ether extract. Tannins, phenolic compounds, and phytosterols are not present in either

extract. Triterpenoids and fixed oils and fats are identified in the petroleum ether extract but are absent in the methanolic extract. Gums and mucilage are lacking in both extracts. This comprehensive assessment of chemical constituents provides essential insights into the makeup of Nyctanthes arbortristis fruit, shedding light on its potential applications in various fields.

Nyctanthes arbortristis fruits exhibit specific phytochemical properties. With a moisture content of 8.70 ± 0.01% w/w, these fruits contain 11.7 ± 0.04% w/w of total ash, 2.16 ± 0.02% w/w of acid insoluble ash, and 3.72 ± 0.02% w/w of water-soluble ash, revealing their mineral content and solubility characteristics. Additionally, the fruits show a sulphated ash content of 5.56 ± 0.04% w/w, reflecting sulfur content. The alcohol-soluble extractive content is 11.73 ± 0.46% w/w, while the water-soluble extractive content is 8.56 ± 0.34% w/w, contributing to the comprehensive profile of these botanical specimens.[32]

This analysis deepens our understanding of the chemical composition of these substances, serving various practical purposes.

HERBAL WONDERS: *NYCTHANTHES ARBORTRISTIS* HEALING POTENTAL

Nycthanthes arbortristis, referred to as NAT, has gained recognition in the Ayurvedic, Siddha, and Unani systems of medicine for its substantial potential as a source of medicinal treatments. It is esteemed for its curative properties across a spectrum of ailments. The biological activity of NAT is evident through documented observations of its effects, derived from crude extracts and various fractions obtained from different plant components, including leaves, bark, roots, seeds, and flowers. This comprehensive assessment underscores its significance in traditional medicine systems.

S. No	Pharmacological effect	Plant Parts	Extracts/ Pure Compounds	Observation Activity	Dose
1	Antiviral activity	Seeds [20]	n butanol fraction, Arbortristoside A & Arbortristoside C and Ethanolic extract	Encephalomyocarditis virus (EMCV) Semliki forest virus (SFV)	125mg/ kg wgt daily dose
		Flower [20]	Its isolated compound	Effect against common floral vector	-
2	Antibacterial activity	Leaves [20]	Methanolic extract	Antibacterial activity against staphylococcus aureus, staphylococcus epidermis, Salmonella paratype, S. typhi	1-8mg/ ml(MIC)
			Chloroform extract	Show both antibacterial and antifungal activity	-
			Petroleum ether & ethanol extract	Show only antibacterial activity	-
		Flower [2]	Ethanolic extract	Moderate activity exhibited	-

		Whole plant [2]	Aqueous, Ethanol, Benzene, Petroleum ether and chloroform extracts	Broad spectrum antimicrobial activity against a panel of bacteria	-
		Fruit [2]	Petroleum ether and methanolic extract	The methanolic extract showed the best antibacterial activity	-
		Flower [2]	Alcoholic extract	Showed antibacterial and cytotoxic activities	-
		Bark [2]	Ethanolic extract	Shows safe and strong activity	-
3	Antiallergy activity	Bark [20]	Petroleum ether, chloroform, ethyl acetate, ethanol and aqueous extracts	Possess antihistamine activity	50-100mg/kg
		Leaves [20]	Alcoholic extracts	Protection against the development of asphyxia	4.0 & 8.0g/kg oral
		Seeds [20]	ArbortristosideA Arbortristoside C	Anti-allergic activity reported	-
4	Antimalarial activity	Leaves [20]	Fresh preparation of leaves paste	Formulated paste showed a potential effects on patients against malaria.	5 leaves thrice a day for 7-10 days
			Methanol & chloroform extract	Showed mosquito larvicidal activity against 3 major mosquito vectors-aedes aegypti, culex quinquefasciatus and anopheles stephensi	-
		Seeds, leaves, roots, flower, stem [20]	50% ethanolic extract	Possess anti-amoebic, antipyretic and anti-allergic properties	-
5	Antidiabetic activity	Root [20]	Methanol extract	It reduces blood glucose levels within 7 days. More effective as compared to standard drug	500mg/kg
		Stem and Bark [23]	Ethanol extract	Possess antidiabetic activity lower the blood glucose level	-

6	Antiparasitic activity	Leaves [23]	50% ethanolic extract	Reported to exhibit trypanocidal activity. Also exhibited potential anti-leishmanial activity in Leishmania donovani infected hamsters.	1000g/ml conc.
		Seeds, roots, leaves, flower, stem [23]	50% ethanolic extract	Found to clear entamoeba histolytica infections.	-
		Bark, flower, seeds and leaves [23]	Ethanolic extract (water soluble portion)	Showed anthelmintics activity	-
7	Antileishmanial activity	Seeds [20]	Iridoid glycosides	Proved to be leishmanicidal agents.	-
8	Anti-filarial activity	Flower [20]	Chloroform extract	It exhibit larvicidal activity against culex quinquefasciatus, a common floral vector	-
9	Hepato - protective activity	Leaves [20]	Ethanolic extract	Protects against carbon tetra chloride induced hepatotoxicity. Extract and silymarin restored all serum and liver parameters which altered by ccl_4 from normal level also prevent loss of body weight.	1000mg/kg wgt for 7 days
		Leaves [20]	Ethanolic and aqueous extract	Reversed the rise in serum AST and total bilirubin.	-
		Leaves [2]	Methanolic extract	Hepatoregenerative potential exhibited by protecting against membrane fragility and preventing the decline of glutathione level	-
10	Anticancer activity	Fruit [20]	Methanol	A high degree of against human breast cancer cell lines was observed (MDA-MB231)	-
		Fruit [20]	Glycosides, tannins, phenols & steroids	Predicted to be responsible for this anticancer activity.	-
		Leaves [20]	Methanol extract	71% inhibition was observed.	30mg/ml conc.

		Flower [23]	Petroleum ether, chloroform & ethyl acetate extract	To exhibit significant cytotoxic activity.	-
		Stem & Bark [23]	Methanolic extract	Reported to exhibit significant activity in comparison to 5-fluorouracil against Dalton's ascitic lymphoma.	-
		Leaves [23]	Ethanolic, methanolic and aqueous extract	Also exhibited appreciable cytotoxicity towards the T-cell leukaemia cell with increasing time and dose.	-
		Flower [24]	Ethanol extract	It demonstrated antiproliferative activities in 5 types of cancer cell lines (Colo205, Y79, K562, MCF7, MDA-MB231)	-
		Flower [24]	Ethyl acetate fraction	This finding indicated that the fraction has a higher selectivity against PBMC-CLL in cancer therapy.	-
		Leaves [24]	Betulinic acid (isolated)	It has proven effective in anticancer in vitro exp on various types of human cancerous cells.	-
11	Antioxidant activity	Leaves [20]	Methanolic extract	(free radical scavenger) On free radical induced lipid peroxidation using bovine brain phospholipid liposomes and found good activity.	20mg/ml
		Leaves [20]	Aqueous extract	Reported to have DPPH radical, hydroxyl radical scavenging activity,lipid peroxidation preventive property.	-
		Stem [20]	Ethanolic extract	A potent source of antioxidants.	-
		Flower [20]	Aqueous extract	DPPH radical scavenging activity. High enzymatic antioxidants.	-
		Leaves [20]	Acetone fraction of ethyl acetate extract	Showed impressive antioxidant activity.	-
		Flower [20]	Methanolic extract	Also exhibit high phenolic content and antioxidant activities.	-

		Leaves [20]	Methanolic extract and flavonoid fraction	Strong reducing power and DPPH scavenging activities.	-
		Dry flower [23]	Aqueous extract	76.48% radical scavenging property.	-
		Dry flower [23]	Methanolic extract	High phenolic content.	-
12	Anti-inflammatory & Analgesics	Whole plant [20]	Aqueous and alcoholic extract	Reported to have acute and sub-acute anti-inflammatory activity.	-
		Stem & seeds [20]	Alcoholic extract	Showed acute and sub-acute anti-inflammatory activity.	-
		Seeds [23]	Arbortristoside A from ethanolic extract	Possess significant and dose dependent anti-inflammatory activity.	-
		Stem bark [20]	Methanolic extract	Extract was reported to have anti-inflammatory and anti-analgesic activities. It prevent the nociceptive component, which may be the cause of inhibition of prostaglandins and related product	500mg/ kg
		Leaves [2]	β-sitosterol isolated from petroleum ether extract	It exhibits analgesics and the anti-inflammatory role which might be due to suppression of formation of prostaglandins and bradykinins	-
		Leaves [2]	95% ethanolic extract	Justified its use in various inflammatory conditions as per the ayurvedic system of medicine	-
		Leaves [2]	90% ethanolic extract	Showed promising result in the acute model than the chronic model.	-
13	CNS depressant activity	Leaves [23]	Alcoholic extraction (water soluble portion)	It has revealed significant tranquilizing activity due to general depression of spontaneous motor activity and significant increases in phenobarbitone sleeping time.	4.0mg/ kg-8.0mg/ kg(oral)
		Leaves [23]	Alcoholic fraction	This fraction possess major tranquilizing activity along with some hypothermic effect. The higher dose	Varied doses

				of extract inhibit prevention of electric shock.	
		Leaves [23]	Hydroalcoholic extract	It have anxiolytic activity.	-
		Leaves [20]	Ethanolic and aqueous extract	Having significant anticonvulsant activity	-
		Flower, bark, leaves and seeds [20]	Ethanolic extract (water soluble portion)	Showed antidepressant activity by decreasing dopamine and increases serotoninlevel.	-
14	Anti-Anaemic activity	Flower, bark, seeds & leaves [20]	Ethanolic extract	Rise in haemoglobin content & RBC count in rate. The extract also protect the decline of hemogram profile in anaemic rat.	-
15	Antimicrobial & Antifungal activity	Leaves [23]	Ethanolic extract (phenolic compound & tannins)	Active against staphylococcus aureus, salmonella Para typhi.	-
		Leaves [23]	Aqueous & alchoholic extract	Activity against gram positive and gram negative strains.	-
		Leaves, flower, fruit and seeds [23]	Chloroform and ethyl acetate extract	Antibacterial activity against gram negative bacteria.	-
		Stem bark [23]	Petroleum ether, chloroform and ethanol extract	It is found to have potential antimicrobial activity against S. aureus, E.coli, P. aeruginosa, Candida albicans & Aspergillus niger.	-
		Leaves [23]	Petroleum ether, chloroform and ethanol extract	Effective in reducing radical growth of 3 fungal pathogens of rice-Pyricularia oryzae, Cochliobolus miyabeanus & Rhizoctonia solania.	-
16	Antiarthritic activity	Fruits, seeds and leaves [2]	Water soluble ethanolic extract	Leaves and fruits extract proven to be antiarthritic	-
		Leaves [2]	95% ethanolic extract	Active toxicity constituents are to be the isolated and underlying mechanism of action is to be studied	-

		Leaves [2]	Ethyl acetate extract	Isolation of responsible phytoconstituents and confirmation of antiarthritic activity is required	-
17	Antipyretic	Leaves [2]	Water soluble	Showed antipyretic effect in various types of fever.	-
		Leaves, seed, stem, flower and root [2]	50% ethanolic extract	Arbor-tristosides of ethanolic extracts of seeds showed significant activity.	-
18	Immunostimula-tory activity	Leaves [2]	Ethanolic extract	Both cellular and humoral immunity stimulation were reported. Elucidation of the extract mechanism is in progress.	-
		Leaves [2]	Aqueous extract	Flavanol glycoside influences humoral and cell mediated immune system of mice. Mechanism of immunomodulatory and probable use in immunocompromised individuals are to be investigated.	-
		Leaves [2]	Water soluble fractions	Significant enhancement of immunity observed in finfish. Investigation on active compound identification and appropriate field trials need to be ascertained for prolonged use at large scale application	-
		Seeds [2]	Methanolic extract	Possess potent immunostimulatory and disease protective properties.	-

CONCLUSION

In conclusion, the comprehensive review of Nycthanthes arbortristis highlights its immense potential as a plant with diverse and valuable pharmacological properties. All parts of this plant are rich in a variety of secondary metabolites, and various solvents have been utilized for the extraction of its active compounds. These extracts have exhibited a wide array of pharmacological activities, including antiviral, antibacterial, antifungal, antimalarial, anti-inflammatory, analgesic, antipyretic, antidiabetic, antiallergy, anticancer, antioxidant, antiarthritic, antianemia, CNS depressant activity, immunostimulatory effects, and antimicrobial properties, among others. Nycthanthes arbortristis stands as a multifaceted medicinal resource. This review aims to consolidate and present a comprehensive collection of information and details related to this remarkable plant.

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