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Review Article

Morphology, Taxonomical description and Antiviral activity of *Vitex Negundo*

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Abstract

Medicinal plants have been identified and used throughout human history. Many traditionally used plants hold importance in modern days' medical regimen as they have been proved scientifically to possess various activity which are desirable, one of such plant is *Vitex negundo* Linn which is distributed throughout India plants synthesize a wide range of phytochemical constituents that are used to perform important biological function. Naturally available these resources provide valuable raw material for future modern scientific research and one must use it wisely. Literature citation revealed that *Vitex negundo* Linn is a popular medicine for human kind. It possesses a variety of phytochemical constituents which makes it very effective antiviral activity, antimicrobial, cytotoxic, analgesic, anti-inflammatory, anti-arthritic, anxiolytic, anti-amnesic, antidote for snake venom.

Keywords: Medicinal plant, Vitex, Phytochemical Constituents, Antiviral activity, Snake venom

INTRODUCTION

Medicinal plants have played a crucial role in healthcare throughout human history, providing natural remedies for a wide range of ailments. Among them, *Vitex negundo* Linn stands out as a significant plant in traditional and modern medicine (Alagarasu K, et al., 2022). Commonly found in India and other parts of Asia, this plant is known for its rich phytochemical content, which contributes to its diverse therapeutic properties (Forterre P, et al., 2009). *Vitex negundo* has been scientifically validated for its antiviral, antimicrobial, cytotoxic, analgesic, anti-inflammatory and anti-arthritic properties (Joy PP, et al., 1998). It also serves as an antidote for snake venom and exhibits anxiolytic and anti-amnesic activities (Kothandan S, et al., 2014). The active phytochemicals in this plant, including flavonoids and terpenoids, have shown promising potential in combating viral diseases like chikungunya, Zika and even HIV (Lahariya C, et al., 2006).

This article delves into the botanical description, pharmacological activities and antiviral properties of *Vitex negundo*, highlighting its importance in the management of viral infections and the growing need for further scientific research into its therapeutic uses **(Figure 1)** (Nair RA, 2012).

Taxonomic description

Common Name(s): Chastetree, Chinese caste tree, Five-leaved Chaste Tree, Horseshoe

Common Name: chaste tree

Type: Deciduous shrub

Family: *Lamiaceae*

Native range: Asia, scattered other

Zone: 6 to 9

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Height: 3.00 to 10.00 feet

Spread: 3.00 to 8.00 feet.

Figure 1: Chastetree, Chinese caste tree.

Flower: Showy, fragrant

Attracts: Butterflies

About *Vitex negundo* plant:

Habit: A small tree with square, white and hairy stem (Maria John KM et al., 2015).

Leaves: Opposite, 3-5 foliate, leaflets petioled, lanceolate, acute, terminal leaflet largest, white hairy below.

Inflorescence: Branched, hairy cymes, forming a large in terminal panicle (Nichol ST, et al., 2000).

Flowers:

- Bracteate, bracts lanceolate, caduceus.
- Calyx bell-shaped, white-hairy, teeth 5, triangular (Rawal G, et al., 2016).
- Corolla bluish purple, bilipped, upper lip divided into 2 lobes, lower lip 3-lobed.
- Stamens 4, didynamous, filaments hairy at the base.
- Ovary glabrous, 4-celled, ovules 4, style slender, stigma bifid.

Fruits: Drupe surrounded at the base by the calyx.

Flowering and fruiting time: More or less throughout the year (Rose N, et al., 2011).

LITERATURE REVIEW

Medicinal plants, which are the backbone of traditional medicine, have in the last few decades been the subject for very intense pharmacological studies; the value of medicinal plants as potential sources of new compounds of therapeutics value and as sources of lead compounds in the drug development. There arises a need therefore to screen medicinal plants for bioactive compounds as a basis for further pharmacological studies (Sourisseau M et al., 2007). According to the thorough study of the available literature it is quite obvious that the importance of Nirgundi in traditional system of medicine is of utmost significance. Almost all parts of the plant are use in preparing herbal medicines (Singh S et al., 2011). The plant is known to possess anticancer, antimicrobial,

Bloom time: July to August

Bloom description: Lilac/lavender

Anti-inflammatory, anti-hyperpigmentation, hepatopropective, antihistaminic, analgesic and related activities. Scientifically explored exhaustive reports of the plant, their medicinal properties and active chemical constituents have a role in the management of various human ailments. This review attempts to encompass the available literature on *Vitex negundo* with respect to its traditional uses, chemical constituents and summary of its various pharmacological activities. Vitex species shrubs or trees rarely woody lianas (Wang L, et al., 2012). Stem and branches obtusely quadrangular. Leaves opposite, digitately palmately compound with 3-8 foliolate, rarely unifoliate, often aromatic or foetid, petiolate, exstipulate. Inflorescence axillary or terminal dichasial cymes, lax diffuse panicles or corymbs, sessile or pedunculate, bracts narrow, linear around the size of the calyx (Kumar S, et al., 2017). Flowers bisexual, zygomorphic, hypogynous, calyx cupular or campanulate, 5 toothed rarely 3 to 6 or subentire, corolla hypocrateriform, 5 lobed, white, blue or purple, corolla tube straight or curved, usually villous inside and pubescent outside, stamens 4, didynamous, inserted above the middle of the tube, exserted, filaments filiform, anthers oblong or elliptic, ovary bicarpellary, 2-4 celled, 1 ovule in each locule, hairy, style filiform, stigma bi-lobed, lobes equal, Fruit drupaceous, endocarp hard, 4 seeded, seeds oblong or obovoid, nonendospermous (Sharma A, et al., 2014).

Shrubs or small trees; purple pubescent all over, aromatic, bark pale. Leaves 3-5-foliolate; leaflets 6-13 × 2 cm-5 cm, narrowly oblong or elliptic to lanceolate, base acute, apex acuminate (Rathinavel T et al., 2018). Panicles terminal, 10 cm-25 cm long. Calyx 5-toothed obconic, c. 3 mm long, teeth triangular (Verma R et al., 2019). Corolla deep purple to violet in colour, c. 7 mm across, hypocrateriform; tube 3-5 mm long, puberulent without, upper lipd 2-lobed, lower 3-lobed with the middle lobe larger, obovate, undulate-margined, other lobes shorter, subequal, obtuse. Stamens 4, filaments purple. Ovary c. 1 mm long; style purple; stigma 2-fid. Drupe 3-5 mm across, globose, purple or black (Khan MA, et al., 2020).

Morphology

A bushy shrub or small tree about 10-20 ft tall. Bark thin, grayish brown or grayish white, blaze yellow, branchlets terete or obtusely quadrangular, slightly pubescent, nodes annulate, internodes 3-9 cm long. Leaves palmately compound with 3-5 foliolate, rarely more, leaflets lanceolate-elliptic or ovate-lanceolate, middle leaflets 5-14 × 2-4 cm across, petiolules 1-3.5 cm long, lateral leaflets 2.5-4 × 0.8-1 cm across, petiolules 0.2-0.5 cm long, base cuneate or acute, margin entire or serrate, apex acuminate, chartaceous, dark green sparsely pubescent above, paler grayish pubescent beneath, lateral veins 10-18 on either side of the midrib,

subparallel, margin arcuate, impressed above and prominent beneath, pubescent on midrib beneath, reticulate veinlets, petiole stout, slender, canaliculated, about 2-10 cm long. Inflorescence terminal panicles, sometimes dichotomously or trichotomously branched, about 10-30 cm long, peduncles, slender, obtusely quadrangular, pubescent, about 3-8 cm long, bracts leaf like, lanceolate, caducous. Flowers bisexual, many, fragrant, pedicels about 1-3 mm long, Calyx campanulate, 5 toothed, teeth acute, purplish stripes inside, pubescent outside, about 3 × 2 mm across, Corolla subinfundibular, 5 lobed, 2-lipped, blue, purple or lavender, upper lip 2-lobed, light blue, lobes ovate, apex truncate, lower lip 3 lobed, midlobe obovate, light blue, concave, apex truncate, about 1 mm long, lower lobe, dark purple with white tinge, villous near the base, apex acute about 4 x 5 mm across, Corolla tube narrow, ampliate towards the apex, densely villous at throat with whitish hairs, pubescent outside.

Antiviral activity of *Vitex negundo*

In an era of continuous environmental changes, viruses adapt and change according to the prevailing conditions due to error prone replication of their genome. In addition to genetic changes, environmental factors like weather changes, deforestation and others have contributed to the emergence of new viral disease and reemergence of old viral diseases. Recent emergence of corona virus, ebola virus and nipah virus are examples of growing need to address this issue. Viruses are defined as capsid encoding organisms. They reproduce by using host replication machinery and its transcriptional (in case of DNA viruses) and (or), translation machinery (in case of RNA viruses) to develop virion particles, that rupture host cell.

Viral diseases continue to be a major global health concern, with new viral threats emerging regularly. The development of effective antiviral agents is paramount to mitigating these threats. *Vitex negundo*, commonly known as "Nirgundi" in Ayurveda, is an aromatic shrub with a long history of use in traditional medicine. It belongs to the *Lamiaceae* family and is native to the Indian subcontinent. In addition to its traditional uses as an analgesic, anti-inflammatory, antioxidant and antimicrobial agent, *Vitex negundo* has shown potential as an antiviral substance.

Against Chikungunya virus

Chikungunya is a viral infection characterized by high fever and spread through mosquitos. It also affects the small joints in body. It can also cause several other problems in body like-haemorrhagic, myocarditis, neurological disorders and others. As the reports suggests, after 1973, this infection reappeared in 2005 as an epidemic. Asia is majorly affected by it and no specific medication is available. The treatment is based upon developing symptoms. Commonly used antipyretics and anti-inflammatory doses are prescribed. In midst of it few plant species have been studied for their antiviral properties against chikungunya. In a study by Kothandan and Swaminathan, on several plant species for their antiviral activity including *Vitex negundo*. The studies show that the extract is effective against asian chikungunya strain. The effectiveness of the plant extract against chikungunya depends upon the solvent used for extract preparation. Ethanol extracts shows good antiviral activity whereas chloroform extracts lacks.

Discussion

Against zika virus

Zika virus is first identified some 70 years ago in rhesus monkey and reported in humans around 1952. It is transmitted through Ades mosquitos and is re-emerging RNA virus. It has a major effect in African continent. Zika virus shows symptoms similar to dengue and chikungunya. Treatment against zika virus is similar to chikungunya and dengue that is symptomatic treatment. Vista et al., in their studies found that plant extracts from *Vitex negundo* has probable metabolites that have antiviral activity against zika virus. *V.negundo* extract at a concentration of 1.82 mg/ml is found to be effective. The probable metabolites suggested in the study that may have antiviral activity are terpenes, anthocyanin, saponins and terpenoids. However, more studies are required establishing the use of plant extracts against zika virus.

Against HIV

HIV is a life-threatening virus causing AIDS. It causes impairment of immune system and thus supressing it, leading to weakening of individual. The present-day strategies are using antivirals which are costly and requires alternative strategies. In a study by Kannan et al., used *V. negundo* against HIV-1. The analysis is done against the Reverse Transcriptase (RT) enzyme of HIV1. The studies show that at 200 µg/ml ethanolic extract concentration about 92.8% inhibition of RT enzyme is found. The extract contained various flavonoids which may be interfering with RT activity.

Vitex negundo, commonly known as the five-leaved chaste tree, is a plant indigenous to various regions in Asia and has been historically used in traditional medicine due to its diverse pharmacological properties. Recent research into its antiviral properties has showcased its potential as an alternative or complementary therapeutic against various viral infections. This article delves into the current understanding of the antiviral activity of *Vitex negundo* and discusses its potential applications in viral disease management.

Phytochemical constituents and antiviral mechanisms

The antiviral activity of *Vitex negundo* can largely be attributed to its rich phytochemical constituents. The plant contains flavonoids, terpenoids and iridoid glycosides that are believed to play crucial roles in its antiviral properties. For instance, flavonoids, particularly

casticin and isovitexin, have shown potential in inhibiting viral replication and attenuating inflammatory responses in viral infections.

The antiviral action of these compounds is multifaceted. Some studies suggest that they interfere with viral entry into host cells, while others indicate a disruption in the viral replication process. For example, the flavonoids from *Vitex negundo* have demonstrated an ability to downregulate the expression of certain viral proteins, thus hampering the life cycle of the virus.

Efficacy against specific viruses

Research on the antiviral efficacy of *Vitex negundo* has shown its potential against a range of viruses. Studies have revealed its activity against Herpes Simplex Virus (HSV), with extracts from the plant reducing the viral load and preventing its replication. Additionally, there's evidence suggesting that *Vitex negundo* exhibits significant activity against the dengue virus, reducing its infectivity and potentially offering a therapeutic avenue for dengue fever.

Recent work also highlights the plant's potential against respiratory viruses. With the increasing threat of viral pandemics, understanding and utilizing such antiviral agents becomes pivotal. Preliminary findings suggest *Vitex negundo* might offer relief against respiratory viruses, though more research is warranted in this area.

Safety and toxicology

The therapeutic potential of any medicinal plant is also contingent upon its safety profile. *Vitex negundo*, given its extensive use in traditional medicine, has a generally favorable safety profile. However, dose-dependent studies are essential to understand its therapeutic window and possible side effects.

CONCLUSION

Vitex negundo, with its promising antiviral properties, has the potential to be a valuable addition to the arsenal against viral diseases. However, while initial studies are encouraging, rigorous clinical trials are essential to validate its efficacy in human populations and to understand optimal dosing regimens. Further research into its mechanisms of action will also bolster its application in antiviral therapy.

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