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An Overview of *Vitex negundo*

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ABSTRACT

Vitex negundo L. (Verbenaceae) is a hardy plant, flourishing mainly in the Indian subcontinent. All parts of the plant, from root to fruit, possess a multitude of phytochemical secondary metabolites which impart an unprecedented variety of medicinal uses to the plant. It is interesting to note that a single plant species find use in the treatment of a wide spectrum of health disorders in traditional and folk medicine; some of which have been experimentally validated. The plant is a component of several commercially available herbal formulations and has also shown potential as an effective bio-control agent. Employment of techniques such as cell and tissue culture would provide means of rapid propagation and conservation of the plant species and, from the point of view of phytochemistry, give scope for enhancement of the quality and quality of bioactive secondary metabolites occurring in the plant.



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INTRODUCTION

Vitex negundo is a woody and higher shrub plant belonging to the family **Lamiaceae**. *Vitex negundo*, commonly known as the Chinese chaste tree five-leaved chaste tree, or horseshoe vitex, is a large aromatic shrub with quadrangular, densely whitish, tomentose branchlets. It is widely used in folk medicine, particularly in South and Southeast Asia. Nochi – (Nir gundi – *Vitex negundo*): Nochi or Nir gundi as it is commonly called is native to Eastern and Southern Africa and Asia. It is found throughout the Indian Subcontinent and can be easily identified by its light purple flowers borne in panicle inflorescence. Nochi is called by different names in different parts of India.

SYNONYMS

- *Vitex cannabifolia* Siebold & Zucc.
- *Vitex incisa* Lam.
- *Vitex incisa* var. *heterophylla* Franchi.
- *Vitex negundo* var. *heterophylla* (Franch.) Rehder

TAXONOMICAL CLASSIFICATION

- Kingdom - Plantae
- Super division - Spermatophyte
- Division - Magnoliophyte
- Subclass - Asteridae
- Order - Lamiales
- Family - Lamiaceae
- Genus - *Vitex*
- Species - *negundo*

VERNACULAR NAMES

Language	Name
Sanskrit	Nirgundika, Renuka, Nirgunda, Nilapushpi, Nilanirgundi,
Assamese	Pasutia, Aggla-Chita, Aslok, Pochatia
Bengali	Nisinda, Samalu, Nirgundi, Nishinda, Sinduari
English	Five-Leaved Chaste Tree, Indian Privet
Gujarati	Nagoda, Nagaol, Nirgari
Hindi	Samhalu, Saubhalu, Nirgandi
Kannada	Bile-Nekki
Malayalam	Indrani
Siddha	Noochi
Tamil	Nirkunnchi, Nallanochi
Telugu	Nallavalli, Vavilli, Tellavavilli
Urdu	Sambhalu, Panjangusht
Arabic	Uslaq

BOTANICAL DESCRIPTION OF *VITEX NEGUNDO*

Flowering season - June to December

Fruiting season - September to February.

Habit - Branched Shrub up to 5 m tall, or small, slender tree

Duration - Perennial

Part(s) used for medicinal purposes - Roots, fruits, flowers, leaves, bark

Leaves - Palmately compound petiole 2.5-3.8 cm long; mostly trifoliate, occasionally Penta foliate; in trifoliate leaf, leaflet lanceolate or narrowly lanceolate, middle leaflet 5- 10 cm long and 1.6-3.2 cm broad, with 1- 1.3 cm long petioles, remaining two sub-sessile; in Penta foliate leaf inner three leaflets have petiole and remaining two sub-sessile; surface glabrous above and tomentose beneath; texture leathery.

Roots - Cylindrical, hard, tough with irregular fractures; the external surface is rough due to longitudinal, narrow, cracks and small rootlets; cut surface shows cork region

greyish brown, middle region greyish-white, and xylem region cream-colored; bark thin, easily separate from wood; wood hard, forming a major part of the root.

Flowers - Bluish-purple, small, informing large, terminal, often compound, pyramidal panicles.

Fruit - The fruit is a rounded drupe, 1 to 3 mm in diameter, 1/3rd to 3/4th of its size surrounded by a dull grey cup-like, persistent calyx along with pedicel; calyx cup may show one or two vertical splits; fruit color is light brown to black; locules two, each containing two seeds; texture is smooth, taste and odor not characteristic.

Seeds - 5-6 mm in diameter.



Flowers of *Vitex negundo*



Leaves of *Vitex negundo*



Fruits of *Vitex negundo*



Roots of *Vitex negundo*



Seeds of *Vitex negundo*

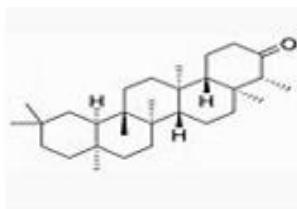


Stem of *Vitex negundo*

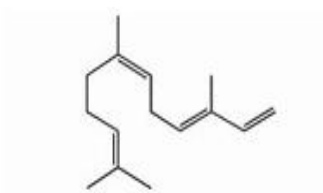
CHEMICAL CONSTITUENTS

Major chemical constituents in leaves of *Vitex negundo* Linn are volatile oil, triterpenes, diterpenes, sesquiterpenes, lignan, flavonoids, flavones, glycosides, iridoid glycosides, and stilbene derivative. They are friedelin, vitamin c, carotene, casticin, artemetin, sabinine, globulol, α -terpineol, Spathulenol, β - Farnesene, farnesol, α -pinene, β -pinene, linalool.

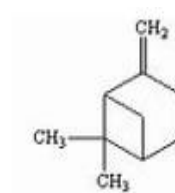
TRADITIONAL USE



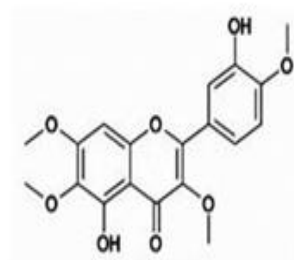
Friedelin



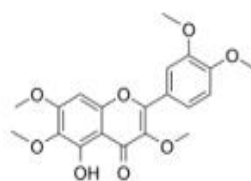
Farnesene



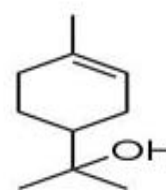
Pinene



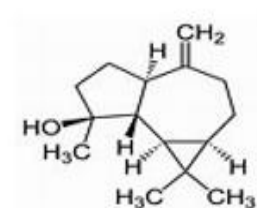
Casticin



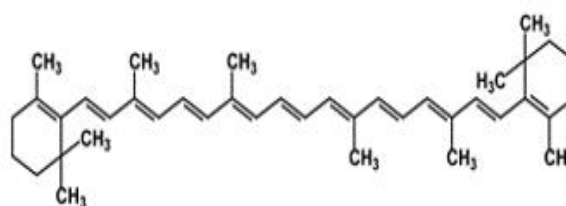
Artemetin



α -terpineol



Spathulenol



Carotene

- The plant is acrid, astringent, cephalic, antiseptic, thermogenic, ophthalmic, anti-inflammatory, antipyretic, and useful in bronchitis, asthma, and enlargement of the spleen.
- Roots are tonic, febrifuge, antirheumatic, diuretic, expectorant and are useful as a demulcent in dysentery in cephalalgia, otalgia, colic, uropathy, wound, and ulcers.
- The bark is useful in odontalgia, erminois, and ophthalmopathy.
- Leaves are bitter, aromatic, acrid, astringent, anti-inflammatory, antipyretic, bronchial smooth muscle relaxant, anti-arthritic, anthelmintic, and vermifuge.

- Flowers are cool astringent, carminative, hepatoprotective, digestive, febrifuge, and vermifuge and are useful in hemorrhage and cardiac disorders.
- Fruit is nervine, cephalic, aphrodisiac, emmenagogue and vermifuge.
- Some villagers use it to clean their teeth.
- *Vitex negundo* leaves are used in grains to protect them from killing insects as well as being bathed in water, which also ends skin diseases.

PHYTOCHEMICAL STUDIES

The whole plant or organism serves as an active laboratory for the production of natural products from primary metabolites. Primary metabolites are the products of vital metabolic pathways such as the respiratory chain, TCA cycle, etc. Secondary metabolites are varieties of simple to sophisticated bizarre molecules. They are fascinating chemical molecules, very useful and of great importance in nature, as well as highly diversified in structures, properties, uses, chemistry, etc.

Extraction

The process of separating active principles from powdered crude drugs by using suitable solvents is called extraction. The choice of solvent depends upon the characteristics of the secondary metabolites like polarity, pH, and thermal stability. Successive solvent extraction is suitable to extract the constituents of different polarities ranging from non-polar to polar.

Methods of extraction

- **Infusion**

Fresh infusions are prepared by macerating the crude drug for a short period with cold or boiling water.

- **Decoction**

In this process, the crude drug is boiled in a specified volume of water for a defined time; it is then cooled and strained or filtered.

e. g. Tea, coffee

- **Digestion**

This is a form of maceration in which gentle heat is used during the process of extraction.

e. g. Extraction of Morphine

- **Percolation**

It is a continuous downward displacement of the solvent through the bed of crude drug material to get the extract.

- **Supercritical fluid extraction**

Process of separating one component from another(matrix) using supercritical fluid as the extracting solvent. Carbon dioxide is known to be the most stable and excellent solvent.

- **Counter-Current Extraction**

A liquid-liquid extraction process in which the solvent and the process stream in contact with each other flow in opposite directions.

- **Microwave-assisted Extraction**

Microwaves are electromagnetic radiations with a frequency from 0.3 to 300GHz.

- **Ultrasonication-Assisted Extraction**

The procedure involves the use of ultrasound waves, which have frequencies higher than 20kHz and have great effects on extraction yield and kinetics.

- **Maceration**

Maceration means to soften. It is an extraction process in which the drug powder is soaked in a suitable solvent in a closed vessel for seven days with occasional shaking at room temperature. After the specified period, the menstruum is strained, and the marc is pressed to obtain the remaining menstruum. This marc is dried at a temperature not exceeding 50 degrees C and is used for extraction with the next solvent.

- **Soxhlet Extraction/Hot continuous percolation**

Here the plant material is continuously flushed with a fresh solvent which is obtained by evaporation and subsequent condensation of the solvent containing extracted materials.

ETHNOBOTANICAL STUDIES

KambhamVenkateswarlu in 2012 - They have reported that this *Vitex negundo* Linn is an Indian plant, which has enormous traditional uses against various diseases and the report was generated through the research activity using modern scientific approaches and innovative scientific tools.

FauziyaBasriet al in 2014 - *Vitex negundo* belongs to the family Lamiaceae and grows as a small tree with thin grey bark. The plant is widely distributed and also has pharmacological actions against a wide spectrum of diseases in the traditional system of medicines. All parts of the plant especially its leaves contain several secondary metabolites such as alkaloids, phenols, flavonoids, glycosidic iridoids, tannins, and terpenes. Therapeutic uses; antimicrobial, anti-inflammatory, astringent, a bronchodilator, CNS-depressant, detoxicant, diuretic, emmenagogue, anticancer and hepatoprotective, etc. It is also used as a repellent, insecticide, and larvicidal. Leaf extract is employed as a nervine tonic, tranquilizer, and vermifuge. In this review, they have reported presenting comprehensive information on phytochemical constituents and therapeutic uses which can be helpful in the development of modern medicine.

Ajay Kumar Meena et al in 2011 - Plants and their active constituents play an important role in the prevention of a variety of ailments. Most of the species of the Genus *Vitex* are used therapeutically in ancient Indian systems of medicine especially, Ayurveda and Siddha. The genus *Vitex* contains about 270 species distributed around the world. These species contain a variety of potentially bioactive molecules, such as iridoids, flavonoids, diterpenoids, derivatives, and Phyto steroids. Most of these species possess analgesic, anti-inflammatory, antimicrobial, antioxidant, hepatoprotective, antihistamine, and anti-asthmatic properties. This work reviews the pharmacological evidence for the effects of extracts of plants from the genus *Vitex*, giving an overview of the most widely studied biological effects and the known phytochemical constituents.

S. Arumanayagam1 and M. Arunmani (2018) - Reported that *Vitex negundo* Linn is a large aromatic shrub used as a traditional medicine for the treatment of antimicrobial, anticancer, and diuretic properties that belongs to the family Verbenaceae. In the present study, an attempt had been made to study the antibacterial and hepatoprotective activity of *V. negundo* (VN) against LPS. The antibacterial activity of leaves, bark, and seeds of VN was tested against different commonly occurring human pathogenic bacteria such as

Staphylococcus aureus, Escherichia coli, Bacillus subtilis, and Klebsiella pneumonia. Among the different extracts and parts of the plant, methanolic extract of leaves showed much more antibacterial activity against these different bacterial strains, especially *E. coli*. VN was checked on HepG2 cells against the toxicity induced by LPS to prove the hepatoprotective activity. We showed that the VN induced ROS using JNK and MAPK pathways, decreased the apoptotic gene expressions such as COX2, IL 1 β , NF κ β , and iNOS in HepG2 cells to protect the liver cells against LPS toxicity.

P. Renuka Devi, R. KokilaVani, and S. Gnana Poogotha - Reported the Anti-Microbial activity of the various leaf extracts of *Vitex negundo* Linn. The antibacterial activity of the leaves of *Vitex negundo* was tested against three bacteria Viz., Staphylococcus aureus Escherichia coli and Klebsiella Pneumonia, the fresh aqueous, heated aqueous extract, chloroform, and methanolic extract of leaves were used for screening their antibacterial potential. The fresh and aqueous extracts of leaves in various dilutions were found to have antibacterial activity against the three bacteria.

CONCLUSION

This review includes the pharmacognostic, phytochemical, and therapeutical uses on the leaves of *Vitex negundo* Linn of the family Lamiaceae.

According to a thorough study of the available literature, it is quite obvious that the importance of Nirgundi in the traditional system of medicine is of utmost significance. Almost all parts of the plant are used in preparing herbal medicines. The plant is known to possess anti-cancer, anti-microbial, antifeedant, anti-inflammatory, anti-hyperpigmentation, hepatoprotective, anti-histaminic, analgesic, and related activities. Scientifically explored exhaustive reports of the plant, its medicinal properties, and active chemical constituents have a role in the management of various human ailments.

V. negundo possesses numerous biological activities proved by many experimental studies. It represents a class of herbal drugs with a very strong conceptual base for its use. Thus, this plant has great potential to be developed as a drug by pharmaceutical industries, but before it recommends for clinical use in these conditions, there is a need to conduct clinical trials and prove its clinical utility.

Medicinal plants, which are the backbone of traditional medicine, have in the last few decades been the subject of 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.

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