A REVIEW ON ETHNOBOTANICAL AND PHARMACOLOGICAL IMPORTANCE OF VITEX NEGUNDO L.

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Abstract—People are using various plants for curing various ailments in their routine life. Vitex negundo L. is a woody aromatic plant and used in different system of medicine. The family of Vitex negundo L. is lamiaceae and is commonly known as cheste tree, nergundi, simli and vanna. It is distributed mainly in tropical to temperate region of the world and is found upto 1500 m amsl in Western Himalaya. This species have ethnobotanical uses, pharmacological activities, strong potential to develop new drug due to presence of chemical constituents and also used in other traditional medicines. The phytochemical analysis of various parts of the species reveals that it has many biomolecules which can be used for curing the diseases. The main constituents of the plants are alkaloids, flavonoids, flavones, lignans, terpenes, vitexoside, nishindine, glycosidiciridoida, phenols and steroids. The plant contributes in various pharmacological properties like anti-inflammatory, anti-oxidant, anti-microbial, immuno-stimulant, anti-cancerous and astringents. The handicrafts can be prepared from the plants which will enhance the livelihood of the people of the fringe villages. The review aims at providing comprehensive information on ethnobotanical uses and phytochemical constituents of the species. The literature was compiled an ethnobotanical and pharmacological significance of V. negundo.

INTRODUCTION

Plant used in traditional, ethnobotanical uses for medicines and treating wide variety of diseases is studied all over the world. The people are using the local available plants for curing diseases and ailments. The various plants have been used by people in one form or the other. The traditional systems of medicines are practiced since the period of our ancestors. Various medicinal plants have been identified and modern scientific approach has been used to observe their efficiency in curing ailments (Meena et al., 2011; Singh et al., 2018). Vitex negundo L. is one of the woody species, mainly found on slopes or degraded areas (Li et al., 2007). The word Vitex is derived from Latin word vieo which means to tie or bind because of its flexible stems and twigs (Ahuja et al., 2015). It is commonly known as five leaved cheste tree (Ambika and Sundrarajan, 2015), Nirgandi in Hindi and Nirgundi in Sanskrit and Simali in Nepali and is a deciduous shrub grows gregariously in wastelands and widely used as a hedge plant (Gautam et al., 2008). The plant can also be used as an ornamental plant and also grown as woody vegetation in agroforestry system. It is also used as fuel wood, medicine and restoration of wasteland. It also reduces the soil erosion on the degraded sites. The stem of the plant is used for the preparation of basket and container for storage of grain. This whole plant has an antiseptic, antipyretic, antihistamine, antioxidant, antibacterial, antifungal, anti-cancerous, inflammation, mosquito repellent, insecticidal, larvicidal, snake venom neutralization, antifertility, antiandrogenic, skin ageing inhibitor and anti-dopaminergic properties (Britto and Sujin, 2012). The leaves also showed an anti-inflammatory, antihistamine and analgesic properties (Dharmasiri et al., 2003). It also contains many compounds like polyphenolic, glycosidiciridoida, terpenoides and alkaloids (Kumar et al., 2010). It is commonly used as a traditional medicinal plant and also has many
pharmacological values (Baral and Kurmi, 2006). Various authors have worked on ethnobotanical and pharmacological importance of *V. negundo* (Chawla et al., 1992; Krishna et al., 2002; Chandramu et al., 2003; Diaz et al., 2003; Khokhra et al., 2008; Singh et al., 2010; Britto and Sujin, 2012; Shamim et al., 2018; Bameta et al., 2019; Maurya et al., 2019; Waghmode, 2020; Das and Muralidharan, 2021). The increasing demand and overexploitation with limited cultivation could lead to its degradation and decline in natural population of this medicinal plant. This review paper deals with the ethnobotanical uses and phytochemical constituents of the species.

**PLANT DESCRIPTION**

The genus Vitex was established by Linnaeus in 1753 with four species of *Vitex* in the family Verbenaceae, but in the 1990s *Vitex* along with several other genera was transferred from Verbenaceae to Lamiaceae on the basis of their DNA sequencing (Shamim et al., 2018). *V. negundo* is an erect, large aromatic shrub or a small size tree with typical five foliate leave patterns (Fig.1) (Rastogi et al., 2010). It is an erect, 4-6m in height, slender tree with quadrangular branchlets, 3-5 leaflets having palmately arrangement, lanceolate opposite, 5-10 cm long, hairy beneath and pointed at both ends (Padalia et al., 2016). The flowers are bluish in colour (Kritikar and Basu, 1987), fruit is succulent, black and round (Gautam et al., 2008).

**Distribution**

*V. negundo* is distributed in tropical to temperate regions of the world (Sunayana et al., 2014) and found in India, Afghanistan, Bhutan, China, Sri-Lanka, Burma, Pakistan, Malaysia, Philippines, Thailand, Madagascar, Eastern Africa and South Asia (Vishwanathan and Basavaraju, 2010; Padalia et al., 2016). It is also cultivated in North America, Europe, and West Indies (Chauhan, 1999). It is common in India from coastal regions to subtropical Western Himalayas and Andaman Islands and found abundantly in drier regions (Venkateswarlu, 2012). It is native to India and found in Assam, Bihar, Delhi, Himachal Pradesh, Karnataka, Kerala and Jammu and Kashmir union territories and found throughout the greater part of India at warmer regions up to an altitude of 1500 m amsl in outer, Western Himalayas (Rastogi et al., 2010).

**Ethnobotanical Uses**

Ethnobotany is the study of the native plants, its uses and the relationship between man and plants. The study of literature reveals that *V. negundo* has been used since ancient times as ethnobotanical plants (Rastogi et al., 2010). The medicinal properties of *V. negundo* is characterized into traditional medicine, and pharmacological medicine (Vishwanathan and Basavaraju, 2010).

Traditional medicine is mainly comprising of Indian Ayurveda, Arabic, Unani and Chinese medicine. In Asia and Latin America, populations continue to use traditional medicine as a result of historical circumstances and cultural beliefs (Dass and Muralidharan, 2021). In Ayurveda, *V. negundo* used in dysmenorrhea, headache and leaves of the species used to dispel catarrh (Jadhav and Bhutani, 2005). In Unani medicine, *V. negundo* commonly known as Nisinda. The seeds are used internally with sugarcane vinegar for relief of swellings and the powder of seeds along with dry *Zingiber officinale* and milk is used in spermatorrhoea (Khare, 2004). In Chinese medicine, the fruits are used in the treatment of headache, redness, puffy and painful eyes and also in arthritis (Liu et al., 2004).

The plants are widely used in the tribal and rural areas as a medicine (Kosalge, 2009). The leaves of *V.
negundo are used in weakness, vomiting, malaria, black fever and leaves are also filled in pillow for curing headache in India, Bangladesh and Malaysia (Khan and Rashid, 2006). Leaf juice is used in cough, common cold and flu in Guangdong of China (Au et al., 2008). The essential oil extracted from leaves is used in curing of sinusitis and whooping cough in Nepal (Joshi and Joshi, 2000). Root decoction is used for the treatment of asthma and bronchitis in India (Basavaraju et al., 2009).

In India, it is widely used in folk medicine for treatment of wounds and body ache (Sharma et al., 2004), relaxing eye pain (Jain and Puri, 1984), jaundice, (Purkayastha et al., 2005; Pattanaik et al., 2008) and liver disorders (Kotoky and Das, 2008), asthma and cancer (Basavaraju et al., 2009), encephalitis (Jagtap et al., 2006), toothache (Sharma et al., 2004), antidote for snake bite (Samy et al., 2008), respiratory disorders, fever and headache (Rajadurai et al., 2009).

The leaves of the species are used for healing swollen rheumatic joints (Sharma and Sood, 2013), leaves used in gastric and leprosy, paste of leaves along with chuli (Albizia chinensis) for treating snake and scorpion bites, flowering tips are chewed for curing ulcers, twigs are used as toothbrush (locally called datun), (Verma and Chauhan, 2007). However, fruits and leaves are used for headache and skin diseases body ache, blisters, cough, cold, fever, diarrhea, piles, swelling, ulcers, wounds and skin diseases and twig is also used for cleaning teeth (Sharma and Mishra, 2009). The leaves are boiled and bath of hot water taken for sprain joint fracture and for relaxing pain (Singh et al., 2018a; Sharma et al., 2015), dried smoked for relief from headache, catarrh useful in dispersing swelling of joints from acute rheumatism and swelling of testis from suppressed gonorrhoea and juice of leaves used for removing foetid, discharges and worms from ulcers (Sharma et al., 2013). The fresh leaves are boiled and vapors are inhaled twice a day for curing, headache, cough, cold and fever (Vidyarthi et al., 2013).

**PHYTOCHEMICAL ANALYSIS**

The phytochemical analysis of *V. negundo* done by various research workers revealed that many types of compounds like lignans, flavonoids, terpenes, volatile oils and steroids are generally found in this species (Chandramu et al., 2003). It contains different secondary metabolites such as poly phenolic terpenoids, glycosidic, iridoids and alkaloids (Koirala et al., 2020). Chitra et al. (2009) also studied the phytochemical analysis on the crude ethanol extract which showed the presence of alkaloids, glycosides, lignin, flavonoids and saponins. The extracts of the plant parts have anti-fungal, antibacterial, anticonvulsant, CNS depressant, antiallergic, immunomodulatory, hepatoprotective, anti-hyperglycemic, antinociceptive, anti-inflammatory, antioxidant, anti-HIV properties and also snake venom neutralization activities (Maurya and Rao, 2019). The phytochemical constituent of the different parts of *V. negundo* has also been described below:

**Leaves**

The phytochemical analysis indicated many compounds like carbohydrates, alkaloids, flavonoids, glycosides, fixed oils, amino acids, terpenoids and steroids in the species (Sharma et al., 2020). Merlin and Cathrine (2011) also reported antibacterial activity and found various compounds like phenol, flavonoids, steroid, quinines and carbohydrates. Leaves also contain an alkaloid nishidine, flavonoids like flavones, luteolin-7-glucoside, casticin, iridoid glycoside, an essential oil and other constituents like vitamin-C, carotene, benzoic acid, β-sitosterol and C-glycoside (Hussain et al., 1992).

The species also have many phytochemical constituents like viridiflorol, β-caryophyllene, sabinene, 4-terpineol, gamma-terpinene, caryophyllene oxide, 1-octen-3-ol,globulol (Singh et al., 1999), protocatechuic acid, oleic acid, flavonoids (Surveswaran, 2007). It also contains 5,32-dihydroxy-7,8,42-trimethoxyflavonone, 5,32-dihydroxy-6,7,42- trimethoxyflavanone (Achari et al., 2007), protocatechuic acid, oleic acid, flavonoids (Surveswaran et al., 2007), angusid, casticin, vitamin-C, nishindine, gluco-nonitol, p-hydroxybenzoic acid, sitosterol (Khare, 2004; Rana and Rana, 2014).

The leaves and twig are stilbene derivative characterized as 4,4’- dimethoxy-trans-stilbene, along with five flavones, 5,6,7,3‘,4’-5-heptamethoxy, 5-hydroxy- 6,7,8,3’4’- pentamethoxy (5-Odemsmylinoobletin), 5- hydroxy-6,7,8,3’,4’,5- hexamethoxy (gardenin A), 5- hydroxy-6,7,8,4’- tetramethoxy (gardenin B) and 5- hydroxy-7,3’,4’,5’- tetramethoxyflavone corymbosin (Chandra and Babber, 1987; Banerji et al., 1988; Kosankar et al., 2000).

The ethanolic extract of the species resulted in the
isolation of new flavones glycoside along with five known compound and characterized as 4',5,7-trihydroxy-3'-O-β-D-glucuronic acid-6''-methyl ester, a new naturally occurring compound named vitexoside (Sathiamoorthy et al., 2007).

**Seeds**

The seeds of *V. negundo* consists of many compounds like vitedoin-A, vitedoin-B, a phenylpaphthalene-type lignan alkaloid, vitedoamine-A (Ono et al., 2004), 6-hydroxy-4-(4-hydroxy-3-methoxy-phenyl)-3-hydroxy-methyl-7-methoxy-3, 4-dihydro-2-naphthaldehyde (Zheng et al., 2009), β-sitosterol, p-hydroxybenzoic acid, 5-oxyisophthalic acid, n-pentatriacontane, n-tritriacontane, n-hentriacontane, n-nonacosane (Khare, 2004). It also contains β-sitosterol, hydrocarbons, phthalic acid and benzoic acid (Hussain et al., 1992).

**Roots**

It consists of negundin-A, negundin-B, vitrofolal-E and vitrofolal-F (Haq et al., 2004); acetyl oleanolic acid, sitosterol, 3-formyl-4,5-dimethyl-8-oxo-5H-6,7-dihydonaphtho (2,3-b) furan (Vishnoi et al., 1983). Vitexoside a new flavonoid glycoside and agnuside, R-dalbergiphenol was recorded (Haq et al., 2004; Dayal, 2004). The isolated compounds from the heartwood of species roots are β-amyrin, oleanolic acid and epifriedelinol (Krishna et al., 2002).

**Essential oils**

Volatile constituents from leaves of species have 66 compounds in which 35 compounds constitutes 74.96% of oil and the main compounds are viridiflorol (19.55%), J3-caryophyllene (16.59%), sabinen (12.07%), 4-terpineol (9.65%), y-terpinene (2.21%), caryophyllene oxide (1.75%), 1-octen-3-ol (1.59%) and globulol (1.05%) (Singh et al., 1999).

Padalia et al., (2016) reported the content of essential oil varied from 0.06 to 0.10% of species and 61 volatile compounds mainly major constituents were sabinen (2.8-40.8%), viridiflorol (10.7%–23.8%), β-caryophyllene (5.3–21.4%), terpinen-4-ol (0.1–7.2%), epi-laurenene (2.2–5.9%), humulene epoxide II (0.5–4.6%) and abietadiene (0.1%–4.3%).

The essential oil yields ranged from 0.06 to 0.10% in the leaves. Flowers of *V. negundo* have formic acid, n-heptane, p-cymene, valencene, β-caryophyllene, trans-α-bergamotene, α-selinene, β-selinene, germacren-4-ol, caryophyllene epoxide, (E) -nerolidol, P-(1,1-dimethylethyle) toluene (Khokra et al., 2008). The antifungal and antibacterial properties of volatile oil against *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, *Bacillus subtilis*, *Micrococcus luteus* and *Candida albicans* using ciprofloxacin and chlorampholincol were investigated by Singh et al., (2010).

**MEDICINAL PROPERTIES**

*V. negundo* is one of the common plants used in traditional medicine in India and also has a large variety of pharmacological properties (Baral and Kurmi, 2006). The uses of different parts of plant are briefly described below:

**Leaves**

Leaves of the species had been reported for its anti-inflammatory, antihistaminic, antioxidant and membrane stabilizing properties (Meena et al., 2011). A decoction with addition of long pepper used to treat catarrhal fever with heaviness of head and weakness of hearing (Venkateshwarlu, 2012). The petroleum ether extract had been reported for larvicidal properties against the *Culex tritaeniorhynchus* and crude aqueous extracts also had laxative properties (Meena et al., 2011). The oil extract had repellent actions against the pests (Hebbalkar et al., 1992). The anti-microbial activity of hexane and methanolic extracts from the leaves are active against the *Mycogone perniciousa*, *Rhizoctonia solani*, *Pseudomonas aflorescens*, *Bacillus megaterium*, *Xanthomonas species*, *Staphylococcus* species (Kaushik et al., 2003).

The phytochemical constituents like reducing sugar, phenol, coumarin, saponins and steroids are source of many useful drugs which is found in the leaves and stems of the species (Bameta et al., 2019). Loganathan et al., (2004) reported antibacterial properties against *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus albus*, *Bacillus subtilis*, *Escherichia coli*, *Klabsiella aerogens*, *Proteus vulgaris* and *Pseudomonas aeruginosa* using agar plate method. The chloroform extract from the species had the vitexicarpin, a flavone which had cytotoxic action against human cancer cell (Diaz et al., 2003).

The antihistaminic property of methanolic extract of leaves is found to be active against histamine release from mast cells (Rimando et al., 1987; Stylian, 1996). The antifeedent activity of ursolic acid, betulinic acid, n-hentriacontanol, β-sitosterol and p-hydroxy benzoic acid from the methanolic extract of
leaves are used against the larvae of Achoea janata (Manohar et al., 2003). Amancharla et al. (1999) tested mosquito repellent activity of aqueous extract in leaves and also found a new chemical ‘rotundial’.

Seeds

The seeds, bark oil and essential oils mixed with Zingiber officinale and Tinospora cordifolia showed anti-inflammatory properties (Jana et al., 1999). Chawla et al. (1992) studied the anti-inflammatory activity of chloroform extract of seeds of species in Sprague-Dawley male rats. The anti-oxidant properties were investigated from the V. negundo seeds such as vitedoin A, vitedoin B and other legnans derivatives (Zheng et al., 1999; Zheng and Luo, 1999; Ono et al., 2004; Waghmode, 2020).

Flower and fruit

The analysis of the flowers revealed that it has astringent, febrifuge, vermifuge, carminative, hepatoprotective properties and are useful in curing haemorrhages and cardiac disorders (Hussain et al., 1992). Mahmud et al. (2009) studied that the fruits have antifungal properties against Aspergillus flavus, Candida albicans, Candida glabrata, Fusarium solani and Microsporum canis. The fruits have chemical properties like nervine, cephalic, aphrodisiac, emmenagogue and vermifuge (Hussain et al., 1992).

Roots

The root of V. negundo is used as a tonic, febrifuge, expectorant, diuretic, increases breast-milk production, regulating hormones and also have progesterogenic properties (Chevallier, 1996). The extracts of the roots of species with Emblica officinalis can be used to treat the lethal action caused by Vipera russelii and Naja kaouthia venom in both in-vitro and in-vivo (Alam et al., 2003). The anti-inflammatory activity of ethanolic extracts of roots is also reported by Singh et al. (2009). The tyrosinase inhibitory potential of lignans isolated from the methanolic extract of roots showed immuno-stimulant activity (Malik et al., 2006).

OTHER USES

Besides medicinal uses V. negundo has various uses like ornamental, manure and growth promoter in agriculture, reclamation of wasteland, erosion control and handicrafts like basketry and grain storage structure, etc. can be prepared from the specis (Ahuja et al., 2015). The plant has also insecticidal properties against mosquito larva, houseflies and tobacco leaf eating larva (Tondon, 2005).

CONCLUSION

The review paper summarizes the importance of ethnobotany and pharmacological properties of V. negundo. The species can be source of manufacturing of modern drugs. It is suggested that plantation of species can be done for increasing its population. The review of literature revealed the V. negundo is treasury for curing many diseases.

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