PART II
VITEX NEGUNDO, LINN.
CHAPTER I
INTRODUCTION
CHEMISTRY OF GENUS VITEX
INTRODUCTION

In the systematic botanic classification\textsuperscript{1,2} the genus \textit{Vitex} belongs to the family \textit{Verbenaceae} as shown below:

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\textit{Verbenaceae Family:}

The verbenas or the \textit{verbenaceae} are mostly herbs, but the family also includes numerous shrubs and trees grouped in 75 genera and 1300 species. They are distributed in south temperate and tropical countries and North America. Many genera are in cultivation. Some of them being highly prized ornamentals, some are economically useful and a number of them are medicinally useful.

This family is separated from the closely related \textit{Labiatae}\textsuperscript{3} by the fact that the ovary here is seldom lobed, whereas in the latter the ovary is commonly deeply four lobed around the style and it is distinguished from the \textit{Boraginacea} by its zygomorphic flowers.

There are many fine ornamentals among the \textit{Verbenas}, with its many species and varieties of brightly flowered plants.
and the shrubby or climbing lantana. Teakwood comes from *Tectona grandis*, a member of this family.

All morphological variations are observed in the species belonging to this family. Leaves are oppositae rarely whorled or alternate, simple or compound, flowers bisexual, rarely regular, usually oblique or 2-lipped, calyx 4-5, rarely 6-8 toothed, corolla gamopetalous, 4-5 lobed, the lobes imbricated, stamens 4 and didynamous or rarely 5 or 2, epipetalous, disk present, ovary superior of 2 or rarely 4 or 5 carpels, entire or 2-4 lobed, 2-5 celled but by false partitions, 4-10 celled, each cell with a solitary ovule or some times 1-celled, style-1, stigma usually 1, fruit a drupe or berry, often separating into druplets.

**Chemistry of the Genus Vitex:**

The species belonging to this genus are true trees or shrubs yielding a few ornamental subjects, about 100 species distributed throughout tropical and sub-tropical regions of both hemispheres; few in temperate regions. Leaves deciduous or persistent, opposite, digitate with 3-7 (rarely 1) leaflets, flowers white, blue or yellowish, in few to many flowered. Cymes which are often panicled, calyx campanulate, usually 5-toothed, corolla tubular funnel form, with 5 lobed oblique and slightly 2-lipped limb; stamens 4; didynamous, often exerted, fruit a small drupe, with a 4 celled stone.

The chemistry of some of the important species belonging to the genus Vitex is described below.
1. *Vitex negundo*, Linn. [Sanskrit: Nirgandi; Hindi: Sambhalu; Bengali: Nishinda; Arabic: Aslaq; Persian: Sisban; Tamil and Malayalam: Vennochi; Telugu: Nallavavili; Kannada: Niragundi].

**Habitat:** In the warmer zone, a universal plant, throughout India. In Thana District it grows freely. A small tree or shrub about 3 ft. high, deciduous, strongly scented.

Sanskrit writers mention two varieties of *Nirgundi*: that with pale blue flowers are called *Sindhuvara* (*Vitex trifolia*) and that with blue flowers is called *Nirgundi*. The properties of both are identical but the latter is generally used in medicine. The root of *Vitex negundo* is considered tonic, febrifuge and expectorant. The leaves are aromatic, tonic and vermifuge. A decoction of *Nirgundi* leaves is given with the addition of long pepper in catarrhal fever with heaviness of head and dullness of hearing.

The juice of the leaves is said to have the property of removing foetid discharges and worms from ulcers. An oil prepared with the juice of the leaves is applied to sinuses and scrofulous sores. The leaves are discutient, and are useful in dispersing swellings of joints from acute rheumatism and of the tests from suppressed gonorrhoea.

The people of Mysore are in the habit of treating febrile, catarrhal and rheumatic affections, by means of a vapour bath prepared with this plant. The use of the decoction of the leaves as a bath in the puerperal state...
of women in India is a common practice. Mahomedans smoke the dried leaves for the relief of headache and catarrh.

Hore⁴ states that the Europeans in Bombay call it the fomentation shrub and that it is used in the hospitals there as a foment in contractions of the limbs occasioned by the land winds. In the Konkan the juice of the leaves with that of Maka [Eclinta alba] and Tulasi [Ocimum sanctum] is extracted and Aivan seeds are bruised and steeped in it and given in doses of six massas for rheumatism.

In ancient⁵ surgical operations and in diseases of painful nature the patient was made insensible by the administration of anaesthetics. In cases of children or of patients having a dread of the knife or where the proper instruments cannot be procured, bamboo, crystal, glass, leeches, fire, caustics, nail, Shefalli (Vitex negundo), hair and finger were used.

Chaturvedi et al.⁶ have carried out the experimental studies on the antiarthritic effect of the indigenous drug obtained by boiling the fresh leaves in water and found to prevent the development of swelling of joints in exptal arthritis.

The leaves contain principally an essential oil and a resin. The oil possesses the odour of the drug and is neutral and almost colourless. The resin dissolves in alkaline solution with a reddish brown colour, softens below 40°C and
gives off aromatic vapours when heated. A tincture of the drug gives a green colour with ferric chloride. The ash of the air dried leaves amounts to 70-75%. The fruits contain an acid resin, an astringent organic acid giving a green colour with ferric salts and a precipitate with gelatine, maleic acid, traces of an alkaloid and colouring matter. The fruits previously dried at 100° gave 6-8° of ash.

The mature leaves of the plant were first examined by Ghose et al. and an amorphous basic substance of an alkaloidal nature (0.03%) was isolated. From alcoholic extract they have also isolated fructose, p-hydroxybenzoic acid, (1) 5-oxyisopathalic acid, (2) 3-4 dioxybenzoic acid (3) and tannic acid (4).

Basu et al. have reported an isolation of a pale greenish essential oil in steam distillation of fresh macerated leaves of plant, in average yield of ~ 0.05%. It was optically inactive and had a characteristic odour. From air dried leaves an alkaloid, m.p. 268-75° (decomp.) was also isolated.

Basu et al. have identified and characterized the alkaloid as nishindine (C_{15}H_{21}ON), m.p. 260°, possessing a quinoline structure. They have also investigated an essential oil obtained from the fresh leaves by steam distillation and showed that it was optically inactive, slightly soluble in water, soluble in about 10 vols. of alcohol and miscible with organic solvents. It had \( d_{23} \) 0.9215; \( n_D^{20} \) 1.475; acid value 2.708;
R = GAL-OYL, m-DIGALLOYL, m-TRIGALLOYL
ester value 24.93; Al value 143.8; aldehydes and ketones 22.5%; phenolic developments 15% and cineole 10.0%.

Basu et al.\textsuperscript{10} have extracted vitamin C (5) and carotenes (6),(7) from the leaves and estimated them by titrimetric and colourimetric methods and showed to be \textasciitilde{} 150 mg and 3500 micrograms per 100 g of leaves respectively.

M. Sirait et al.\textsuperscript{11} have shown that the leaves of this plant, which are said to have hormone like activities, contain three flavonoids namely, casticin; luteolin-7-D-glucoside (8) and a D-glucoside of an unknown 5-hydroxy-flavone derivative.

R. Haensel et al.\textsuperscript{12} have isolated aucubin (9), agnuside (10), casticin and luteolin-7-glucoside, $C_{21}H_{20}O_{11}$ m.p. 258° from the wood of \textit{V. negundo}.

A. Banerji et al.\textsuperscript{13} have isolated 5-hydroxy-3,6,7,3',4'-pentamethoxy flavone (11) from the pet. ether extract of the leaves.


\textbf{Habitat}: Scattered throughout India in the tropical and sub-tropical regions from the foot of the Himalayas to Ceylon.

The leaves are used in special diseases and after pasturisation and also in cutaneous diseases, said to regulate the bile and increase the appetite, also applied externally in enlarged spleen, sprains and rheumatism.
The powdered leaves have been given with success in cases of intermittent fevers, and flowers are prescribed with honey in fevers accompanied with vomiting and severe thirst.

Fruit employed in amenorrhoea.

Werner Doepke has isolated a new alkaloid, Vitricin, from the alcoholic extract of the dried fruit in ~0.01% yield, m.p. 237° (decomp.), [α]$_D^{24}$ +108° (c 0.2, CHCl$_3$).

Midian Sirait et al. have reported an isolation of a glucoside, agnuside (m.p. 146-8°C) (10) from the leaves.

3. V. agnus-castus, Linn. [Persian: Panjan gusht; Arabic: Athlak].

The seeds are bitter, these are boiled in ghee and the mixture given to horses for colic. The whole plant is medicinally useful. It is used as a cure for eye diseases and stomach-ache, for pains due to chills, one who has caught cold takes a bath in water in which the leaves have been boiled.

Ludwig Kroeber has reported the following constants for the fluid extract of this plant: d$_19$ 0.963; dry residue 4.130%; ash 0.810%.

Kurt Breitwieser has studied and reported the anthelmintic properties of this plant.

O. Fernandez et al. have carried out the analysis of domestic rubber bearing plants (viz. Vitex-agnus-castus) and they have determined the benzene extractable material,
rubber and sterols from the stalks and roots of this plant. The values are 0.206, 0.021% and zero respectively.

I. Belic et al.\textsuperscript{19} have studied biological activity of the pet. ether extract of ground, air-dried seeds of this plant and showed a progesterone like effect in experiments on mature female rats.

E. Winde et al.\textsuperscript{20} have isolated agnuside, aucubin and p-HO-C\textsubscript{6}H\textsubscript{4}CO\textsubscript{2}H (p-hydroxy benzoic acid) from the methanolic extract of the leaves. Agnuside is the p-hydroxy benzoic acid ester of aucubin.

\begin{align*}
\text{Agnuside, 0.3\% yield, m.p. 145-6^{\circ}, [\alpha]_D -31.5^{\circ} [\text{EtOH}].} \\
\text{Aucubin, m.p. 182^{\circ} [\text{EtOH-H}_2\text{O}], C_{15}H_{22}O_9.}
\end{align*}

I. Belic et al.\textsuperscript{21} have isolated a flavone casticin which is a quercetagetin derv; 5,3'-dihydroxy-3,6-7,4'-tetramethoxy flavone, C\textsubscript{19}H\textsubscript{18}O\textsubscript{3}, m.p. 186-87\textsuperscript{0}, from the pet. ether extract of the seeds.

Sirait et al.\textsuperscript{22} have also reported an isolation of casticin [5,3'-dihydroxy-3,4'-6,7-tetramethoxy-flavone] from CHCl\textsubscript{3} extract. They have also found two additional flavone glucosides besides casticin. These are:

1. Luteolin-7-glucoside, C\textsubscript{21}H\textsubscript{20}O\textsubscript{11} (m.p. 258\textsuperscript{0});
2. \(\alpha\)-D-Glucoside of a tetrahydroxy monomethoxy flavone, C\textsubscript{22}H\textsubscript{24}O\textsubscript{12} (m.p. 245\textsuperscript{0}).

R. Haensel et al.\textsuperscript{23} have isolated homo-orientini (m.p. 238-39\textsuperscript{0}) (decomp.)\textsuperscript{12} from MeOH extract of the dried and powdered leaves and stems.
4. *V. peduncularis*, Wall: [Hindi: Nagbail; Bengali: Goda; Assami: Osai; Kannada: Navaladi]. It is widely distributed in Bihar, Bengal and Assam. A middle sized or large deciduous tree, 20-40 feet, bark thick, wood purplish or reddish grey, hard, close grained.

In Chota Nagpur the bark is used for making an external application for pains in the chest. Infusion of leaves, roots, bark or young stems is used in malarial and black water fever.

Vaughan\(^2^4\) has reported the use of infusions and extracts of leaves or bark of this plant in malarial fevers. The drug is non-toxic, not bitter, mildly stimulant, diuretic and does not seem to depress the heart.

Gupta et al.\(^2^5\) have described the role of *Vitex peduncularies* as an antihemolytic agent. It is reported that the *Vitex* might inhibit the hemolysis that occurs in black water fever and that as many cases of this condition follow, the administration of quinine, it might be advantageous to give *Vitex* before quinine to those malaria patients who seem liable to black water fever. *Vitex* is an infusion of leaves. They have found aqueous decoctions of the bark possesses considerable anti-haemolytic activity against saponin, cobra-venum, bile salts and saline solutions in vitro or in vivo.

V.N. Sharma\(^2^6\) has isolated a flavanone, vitexin, \(\text{C}_{15}^\text{H}_{14}^\text{O}_7\) (m.p. 259°) from the ethanol extract of the bark and leaves.
CH. Bheemasankara Rao and V. Venkateswaralu also studied the root bark and leaves and isolated a substance similar to vitexin, but they have modified the structure of vitexin and shown that vitexin is an apigenin derivative. The mol. for vitexin is suggested to be $\text{C}_{21}\text{H}_{20}\text{O}_{10}$ (m.p. 265-65$^\circ$) (13).

In 1962 they reported a structure of vitexin which is based on chemical and physical properties. The mol. formula was worked out to be $\text{C}_{21}\text{H}_{20}\text{O}_{10}$ (m.p. 264-65$^\circ$) with three phenolic and four alcoholic hydroxyl groups. The chemical reactions established the structure of vitexin as 8-C-(1,5-pyranogluco-yl)-apigenin.

D.S. Rao also reported an isolation of vitexin in 0.02 - 0.8% yield from the bark of leaves and stems.

5. V. pubescens, Vahl.: [Tamil: Myladi; Telugu: Bas; Uriya: Muria].

A large evergreen tree, 30-50 feet high, wood brown, very hard, branches quadrangular.

It occurs on the East side of Orissa, Chota Nagpur, East Bengal, Chittagong, on the West sides from the Nilgiris, Southern parts of Burma and Andamans. Flowers in January-May.

Its resin is burnt with Dhatura seeds to produce lethargy in Malaya.

Phana Douk had studied the chemical composition of the leaves and reported that the leaves of this specie showed traces of a cyanogenetic compound and of flavonoids.
including C-flavonoids. No chromogenic heteroside was found, but of the catechic tannins, a leucoanthocyanine was discovered.
SUMMARY

The position of genus *Vitex* (Family: *Verbenaceae*) in the Plant Kingdom is outlined.

The chemistry of genus *Vitex* is also reviewed. The species coming under this genus contain carbohydrates, alkaloids, aromatic acids, vitamins, carotenes, C-glyco-flavonoids etc. Various medicinal properties attributed to these species are described.
REFERENCES

18 Obdulio Fernandez and Ramon Núñez, *Farm. nueva* 11, 559-72 (1946); *Chem. Abs.* 41, 2599 (1947).


