



A COMPREHENSIVE OVERVIEW OF A TRADITIONAL MEDICINAL HERB: *CLERODENDRUM INFORTUNATUM* LINN.

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ABSTRACT

Clerodendrum infortunatum Linn (verbanacea) is one of the commonly used traditional plants for several purposes throughout the plains of India., including tropical regions of Myanmar, Pakistan, Thailand, Bangladesh and Sri Lanka¹. It is used as ailments like tumor, diarrhea, skin disorder, venereal and scrofulous complaints ,wounds,wormicide², post natal complication, as vermifuge, febrifuge in malarial fever specially in children, laxative, cholagogue, for removal of ascarids in anus ,as antidote for colic, scorpion sting and snake bite. The present review explores the historical background, chemical constituents, pharmacological actions, uses and future aspects of this novel herbal drug to be available for human health industry commercially.

KEYWORDS: *Clerodendrum infortunatum*, phytomedicine, antimicrobial, diabetogenic

INTRODUCTION

Clerodendrum infortunatum well known for their traditional uses in various regions around the globe .This is commonly known as Saraswat leaf other name are Bhant (Hindi), Bhagri (Sanskrit), Bhandari (Marathi), Bhat, Ghetu (Bengali), Bhandika, Bhantaka, Bhargi (Sanskrit). As per a report this plant has been widely used by the khumis tribe, mostly inhabiting the thanchi sub district of Bangladesh district in Chittagong hill tract of Bangladesh, for ailments like burning sensation in the chest, salt taste in mouth, flatulence and gastric pain³ Among tribal of sylheti Bengali community of barak valley, Assam this plant is used in the preparation recipe commonly known as shuktani, a herbal remedy used for various ailments.⁴

Collective information from various sources mention, every parts of the plant are used for different ailments. Stem used for toothache, shoots and leaves extract given in purulent discharge from vagina; stem bark powder is given as snake bite antidote. Root paste in mother's milk given to children as anthelmintic. Root decoction drunk for malaria and fevers. Leaves and roots applied for tumors and skin disease, decoction given in cholera. Leaves and flower in scorpion sting and sprouts in snake bite.

MORPHOLOGY

Clerodendrum infortunatum is a flowering shrub (Figure 1). The stem is erect, 0.5–4 m high, with no branches and produce circular leaves with 6 inch diameter. Leaves are simple, opposite; both surfaces sparsely villous-pubes-cent, elliptic, broadly elliptic, ovate or elongate ovate, 3.5–20 cm wide, 6–25 cm long, dentate, inflorescence in terminal, peduncled, few-flowered cyme; flowers white with purplish pink or dull-purple throat, pubescent. Fruit berry, globose, turned bluish-black or black when ripe, enclosed in the red accrescent fruiting-calyx. The tubes of the flowers are about 4 inch (10 cm) long and

droop downward, and the expanded corollas are about 2 inch (5 cm) across. It flowers from April to August⁵.



Figure 1: *Clerodendrum infortunatum* Linn.

CHEMICAL CONSTITUENTS

Thorough phytochemical study of this plant has made valuable information regarding the various constituents, which support its, therapeutically traditional uses among the people in different regions around the globe. The various standard phytochemical screening of *clerodendrum infortunatum* with different parts and extract has revealed those possible constituents. In Crude leaf extract it has been found to contain alkaloids, flavonoids, phenols, terpenoids, steroids, fixed oils, sugars (Table 1)⁶ proteins, quinines, glycosides, saponins, carbohydrates, phytosterols^{7,8}. It has also confirm that the leaves contain certain amount of tannin, riboflavin, ascorbic acid and thiamine.⁸ The powdered bark of root ethanolic extract showed the presence of carbohydrates, steroids, tannins, flavonoids⁹, saponins and alkaloids¹⁰. The ethanolic extract of the whole plant confirm the presence of stigmasterol derivative and the compound which was characterized as (22*E*, 24*S*)-stigmasta- 5, 22, 25-trien-3*b*-ol¹¹. (Figure 2)

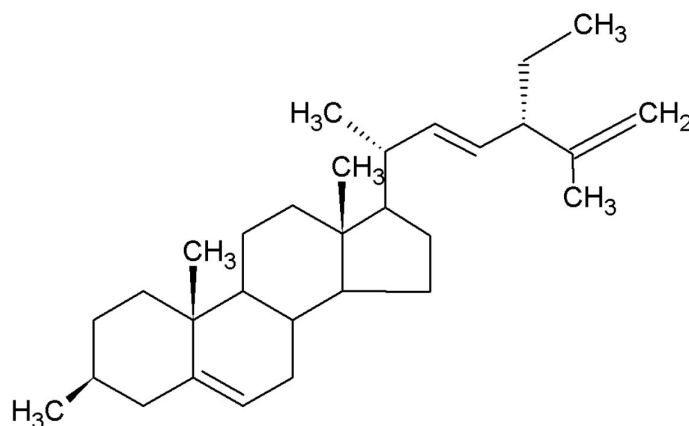
Stigmasterol derivative

Figure 2: (22E,24S)-stigma-5,22,25-trien-3b-ol

Chemical ConstituentsTable 1: Chemical Constituents in leaf extract of *Clerodendrum infortunatum*

Group	Compound
Phenolics	Acetoside, fumaric acid, methyl and methyl esters of caffeic acid
Flavonoids	Apegerin, acacetin and methyl ester of acacetin-7-o-glucuronide, cabrabin, quercetin, scutellarein, scutellarein-7-o-β-D-glucuronide, hispidulin
Steroids	Clerodolone, clerodone, clerodol and a sterol clerosterol
Terpenoids	Clerodin (saponinditerpenoid)
Fixed oil	Glycerides of Lenolic, oleic, stearic and lignoceric acid
Sugars	Raffinose, lactose, maltose, sucrose, glucose and fructose

PHARMACOLOGICAL ACTION

Traditionally therapeutics history of this plant is very rich, time to time various researches undertook place, which validate the application as a natural herbal phytomedicine.

Toxicity study

Acute toxicity was performed according to the OECD guideline 425; it was assumed that it is safe up to a dose of 2000mg/kg¹²

Antihyperglycemic activity

This study has shown preclinical antihyperglycemic activity of dose dependent treatment of methanolic extract of *clerodendrum infortunatum* leaf in streptozotocin induced diabetic rats. Streptozotocin is an antibiotic obtained from *Streptomyces achromogenes* which possesses diabetogenic properties used to induce diabetes mellitus in experimental animals¹³. It has been observed that, increase in blood glucose level after the treatment with streptozotocin, has brought to normoglycemic level after 15 days of treatment of methanolic extract of the plant leaf at 500 mg/kg b.w. dose and which has shown comparable effect exerted by the reference drug, glibenclamide, at the dose of 0.5 mg/kg b.w. Along with this data methanolic extract of the plant leaf restored the other parameters towards normal levels in a dose-dependent manner, like body weight, GOT, SGPT, and SALP in diabetic rats.^{14,15} Experimental results also confirm root extract (500mg/kg) reduced blood glucose level¹⁶.

Analgesic activity

In a study acetic acid induced writhing test was performed by injecting 1.2 %v/v acetic acid in adult swiss albino mice. Isolated saponin from the leaves was injected i.p in different doses. Acetylsalicylic acid, paracetamol and morphine sulphate

was used as standard reference. Protection produced by saponin against acetic acid-induced writhing test was found to be dose dependent and its ED₅₀ value was found to be 40(32.50-49.20)mg/kg ip and therapeutic index was 9.4. In another study hot plate method was performed. Pentozicin and aspirin were taken as the reference drug. The minimum effective dose of isolated saponin was found to be 35(29.4-42.0) mg/kg i.p. This results show saponin significantly reduced the number of writhing episodes induced in mice by acetic acid administration and prolonged the reaction time (hot plate method), suggesting its central as well as peripheral analgesic activity respectively¹⁷.

A significant peripheral analgesic activity was also reported at 200 mg/kg by acetic acid induced writhing reflex method, whereas no activity was reported in tail immersion method.¹⁸ Marked central analgesic effect was observed by tail flick method, when leaves extract was treated in swiss albino rats¹⁹. Root extract of the plant has also shown significant activity by in swiss albino mice by hot plate, tail immersion, acetic acid induced writhing and formalin test method²⁰.

Anticonvulsant activity

Leptazol induced seizures was performed in which isolated saponin from the leaves *clerodendrum infortunatum* was administered i.p in varying doses prior to the administration of Leptazol in mice. This show that it significantly inhibited the onset and the incidence of convulsion against leptazol-induced seizures, protection produced against leptazol-induced convulsion was found to be dose dependent and ED₅₀ and therapeutic index was determined to be 45(30.2-65.0)mg/kg, ip and 8.3 respectively¹⁷.

Hepatoprotective activity

To evaluate the hepatoprotective potential plant, methanolic extract of leaves were subjected to be injected at doses 100mg/kg and 200mg/kg b.w against carbon tetrachloride induced oxidative damage in adult male wistar rats. Silymarin was taken as standard reference. Different serum biochemical parameters were assayed like glutamate pyruvate transaminase (ALT), glutamate oxaloacetate transaminase (AST), alkaline phosphatase (ALP), bilirubin and total protein. Malondialdehyde (MDA) level, reduced glutathione (GSH) content and catalase activity (CAT). Elevated level was found to significantly normalize. Histopathological study also reveals that it has moderate hepatoprotective activity²¹.

Antioxidant activity

Ethanol extract of the plant leaves was evaluated for antioxidant property by DPPH radical scavenging assay, FRAP

assay (Ferric Reducing Antioxidant Power) and hydrogen peroxide radical scavenging assay. This study revealed that the plant extract has significant antioxidant activity.²² In another study Methanolic leaves extract of the plant was evaluated for its antioxidant property by free radical scavenging activity, total antioxidant capacity, nitric oxide scavenging activity and reducing power test by using ascorbic acid as the standard, in which it has been shown that the extract has moderate antioxidant property²³. Further its antioxidant potential was studied using its leaves, stem and root 70 % methanolic extract by examining in various assay, which has confirmed its potent in vitro antioxidant and ROS scavenging activity²⁴ (Table no 2). Significant Antioxidant activity was also observed in methanolic root extract of the plant which was determined by DPPH scavenging activity taking quercetin as standard and which has shown dose dependent reducing power ability when compared with quercetin.⁹

Comparison of the antioxidant Activity

Table 1.2: Comparison of the antioxidant and free radical scavenging capacities of 70% methanolic extracts of *Clerodendrum infortunatum* leaf, stem and root

Name of the assay	70% methanolic extract of <i>Clerodendrum infortunatum</i>			Standard
	Leaf	Stem	Root	
DPPH	L	H	H	Ascorbic Acid
Hydroxyl radical	H	M	L	Mannitol
Superoxide anion	H	M	L	Quercetin
Nitric oxide radical	H	M	L	Curcumin
Hydrogen peroxide	-	-	-	Sodium pyruvate
Hypochlorous acid	H	L	L	Ascorbic acid
Peroxynitrite	-	-	-	Gallic acid
Singlet oxygen	L	L	L	Lipoic acid
Iron chelating activity	L	L	L	EDTA
Lipid peroxidation	-	-	-	Trolax

Activity: high (H), Moderate (M), Low (L): compare to each other.

Antimicrobial activity

Screening for different extract like petroleum ether, chloroform, acetone, benzene, ethanol etc were performed using a wide range of bacterial strains. Report suggest in a study of different concentration (20, 60, 100mg/ml in DMSO) using Punch well method. The results obtained showed that the petroleum ether fraction exhibited a significant activity against *Staphylococcus aureus*, chloroform extract showed activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Shigella*, *Vibrio cholera*, acetone extract showed significant activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Shigella*, *Vibrio cholerae* and ethanol extract exhibited the activity against *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Shigella*, *Vibrio cholera*. Benzene extract did not show any activity against any of the pathogens used in the test²⁵. Antibacterial activity when study by agar well diffusion it show ethanol to the most active against the tested strains *Bacillus subtilis*, *Xanthomonas phaseoli*, *Erwinia*

chrysanthemi, *Escherichia coli*, *Actobacterium tumefaciens*. Chloroform remains active against *Actobacterium tumefaciens*. Whereas resistance was observed in hexane²⁶. In other study it has been also shown that 500 mg/ml ethanol extract has significant activity in both bacterial and fungi (*Proteus vulgaris*, *Bacillus subtilis*, *Escherichia coli*, *Staphylococcus aureus*, *Aspergillus Niger*, *Aspergillus flavus*, *Candida albicans* respectively)²⁷. Antibacterial and antifungal activity was performed by disc diffusion assay method²⁸, were methanolic and acetone extract were used. Antibacterial activity was screened at a concentration of 400 µg/disc both the extract were effective against *Sarcina lutea*, *Escherichia coli* and *Shigella sonnei* whereas 400 µg/disc & 200 µg/disc of both the extract were inactive along with the other tested strains (*Bacillus subtilis*, *Bacillus megaterium*, *Bacillus cereus*, *Shigella shiga*, *Shigella dysenteriae*). Antifungal activity was inactive against (*Aspergillus niger*, *Aspergillus fumigatus*, *Candida albicans*, Human-3 sp and *Fusarium sp*)^{29,31} (Table 3)

Antimicrobial Activity of *Clerodendrum Infortunatum* Linn

Table 3: Antimicrobial activity of *clerodendrum infortunatum* in different solvents

Name of the microorganism	Extract					
	Petroleum ether	Chloroform	Acetone	Methanol	Ethanol	Ethyl Aceate
<i>Staphylococcus aureus</i>	+	+	+	-	+	-
<i>Pseudomonas aeruginosa</i>	-	+	+	-	+	-
<i>Escherichia coli</i>	-	+	-	+	+	-
<i>Shigella</i>	-	+	+	-	+	+

<i>Vibrio cholera</i>	-	+	+	-	+	-
<i>Klebsiella pneumonia</i>	-	-	+	-	+	-
<i>Bacillus subtilis</i>	-	-	-	-	+	-
<i>Xanthomas phaseoli</i>	-	-	-	-	+	-
<i>Actobacterium tumefaciens</i>	-	+	-	-	+	-
<i>Erwinia chrysanthemi</i>	-	-	-	-	+	-
<i>Proteus vulgaris</i>	-	-	-	-	+	-
<i>Aspergillus niger</i>	-	-	-	-	+	+
<i>Aspergillus flavus</i>	-	-	-	-	+	+
<i>Candida albicans</i>	-	-	-	-	+	+
<i>Sarcina lutea</i>	-	-	-	+	+	-
<i>Shigella sonnei</i>	-	-	-	+	+	+
<i>B. megaterium</i>	-	-	-	-	+	+
<i>S. typhi</i>	-	-	-	-	+	+
<i>S. dysenteriae</i>	-	-	-	-	+	+
<i>K. pneumoniae</i>	-	-	-	-	+	+

- Absent, + Present

Cytotoxicity activity

In the Brine Shrimp lethality study, it showed potent cytotoxicity against brine shrimp nauplii (*Artemia salina*) (LC50: 21.38 µg/ml)²⁹

Nootropic activity

Methanolic extract of the plant leaves has shown to be a potential memory enhancer agent by using the Hebb William maze and Y maze in adult albino wistar mice¹⁷

Anti-inflammatory

In Carrageenin induced rat paw edema in wistar albino rats show that significant activity of ethanolic extract of the leaves at dose of 150 and 300 mg/kg⁹.

Anti cancer

According a reported data, root extract of the plant has been evaluated for anti cervical cancer cell bioactivity, which has shown to posse's apoptic, antiproliferative and anti migratory activity in a dose dependent manner against cervical cancer cell lines³⁰.

CONCLUSION

The increasing number of research work around the globe has enlightened the therapeutic application of this plant for various ailments such as antihyperglycemic, analgesic, anticonvulsant, antioxidant, antimicrobial, cytotoxicity, Nootropic, anti-inflammatory and anti cancer which support the widespread traditional uses. This is expected in near future to develop a new drug from its compounds after extensive studies of its constituents, mechanism of action and pharmacological effects.

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