



- A Review

CLERODENDRON INERME : AN UPDATE OF ITS INDIGENOUS USES, PHYTOCHEMISTRY AND PHARMACOLOGY

**SURYA PRAKASH GUPTA^{*}, SIDDHANT SOMKUWAR and
GOPAL GARG^a**

Rajiv Gandhi Institute of Pharmacy, SATNA – 485001 (M.P.) INDIA

^aVNS College of Pharmacy, BHOPAL (M.P.) INDIA

ABSTRACT

Clerodendron Inerme L belonging to family Verbenaceae is very widely distributed in tropical and subtropical regions of the world and is comprised of small trees, shrubs and herbs. Ethno-medicinal importance of various species of *Clerodendron* genus has been reported in various indigenous systems of medicine and as folk medicines. Different parts of this plant are traditionally claimed to be used for the treatment of cough, skin rashes boils and fever. They are also used to treat umbilical cord infection and for cleaning uterus in local medicine. There has been a tremendous interest in this plant as evidenced by the voluminous work in last few decades. Therefore, It has been aimed to compile an up to date and comprehensive review of *Clerodendron Inerme* that covers its traditional and folk medicine uses, phytochemistry and pharmacology including various preclinical and clinical studies.

Key words: *Clerodendron Inerme*, Verbenaceae, Pharmacological activities, Phytochemistry.

INTRODUCTION

Plants have been an integral part of human society since the start of civilization. The role of traditional medicines in the solution of health problems is invaluable on a global level. Medicinal plants continue to provide valuable therapeutic agents, both in modern and in traditional medicines¹. India is rich in its plants diversity. A number of plants have been documented for their medicinal potential, which are in use by the traditional healers, herbals folklorists and in Indian systems of medicine namely, Ayurveda, Unani, Siddha apart from Homeopathy and Electropathy. These plant species play major role in the health care of the

* Author for correspondence; E-mail: suryatony@yahoo.co.in

nation's population². With the associated side effects of the modern medicines, traditional medicines are gaining importance and are now being studied to find the scientific basis of their therapeutic actions³. Research work on medicinal plants has intensified and information on these plants has been exchanged. This research will go a long way in the scientific exploration of medicinal plants for the benefit of man and is likely to decrease the dependence on synthetic drugs⁴.

Clerodendron Inerme L belonging to family Verbenaceae is very widely distributed in tropical and subtropical regions of the world and is comprised of small trees, shrubs and herbs. Ethno-medicinal importance of various species of *Clerodendron* genus has been reported in various indigenous systems of medicine and as folk medicines⁵. *Clerodendrum inerme* is a sun loving plant and a sunny spot should be chosen for it. The plant produces suckers and seeds. The plant has medicinal properties. People who are familiar with this plant use a poultice made of its leaves to suppress buboes and the leaf juice as an alternative. Leaves and roots of the plant are used in rheumatism and skin diseases⁶. *Clerodendron inerme* (L.) Gaertn. is one such medicinal plant popularly known as "Sangkupi" in Hindi and "Peechangu" in Tamil. Different parts of the *Clerodendron inerme* (*C. inerme*) plant products are used in the Ayurvedic medicine for the treatment of rheumatism, skin disease, venereal infections, beri-beri and tumours⁷.

Taxonomy⁸

Kingdom : *Plantae*

Subkingdom : *Tracheobionta*

Superdivision : *Spermatophyta*

Division : *Magnoliophyta*

Class : *Magnoliopsida*

Order : *Lamiales*

Family : *Verbenaceae*

Genus : *Clerodendrum* L.

Species : *Clerodendrum inerme* (L.) Gaertn

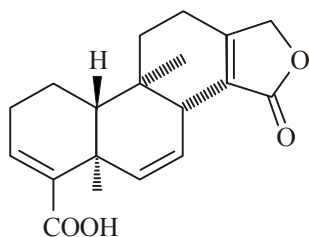
Botanical description

Clerodendrum Inerme is an evergreen mangrove plant, a hardy, straggling shrub and reaches a height of 3-4 meters with closely arranged, almost round, shiny, deep green leaves.

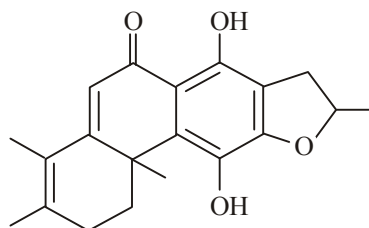
The plant is always in flower. The flowers are white with spreading five corolla lobes, 3 cm long white tubes and long purple stamens. As the specific name implies, the stems are smooth and are devoid of thorns. Leaves ovate to elliptical (5-10 cm) long, acute to acuminate tip, green, smooth, slightly shiny upper 2 surface, pinnate venation, margins entire, leaves opposite, simple. Cyme or umbel usually comprised of 3 flowers joined at a common base point; corolla white, fused, with 5 lobes; stamens 4, reddish to purple and upwardly curved. Fruit green turning black, 1 – 1.5 cm long, obovoid.⁹

Phytochemistry

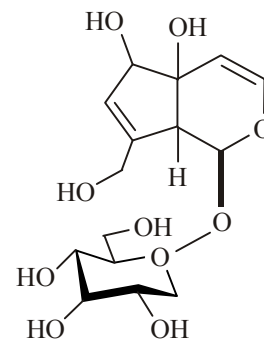
In preliminary studies of this plant, carbohydrates, steroids, flavonoids, volatile constituents, and terpenes have been isolated. Other constituents include ribosome-inactivating protein, salidroside, jinoside-D, acetoside; Steroids such as β -sitosterol, γ -sitosterol octacosanol, clerosterol, bungein A, acteoside, betulinic acid, clerosterol 3-O- β -D glucopyranoside, colebrin A-E, campesterol, 4 α -methylsterol, cholestanol and 24- β -22-25-bis-dehydrocholesterol have been isolated¹⁰⁻¹⁶. Another class of constituents is terpenes, which include monoterpenes, diterpenes, triterpenes, iridoids and sesquiterpenes. Terpenes such as α -amyrin, β -amyrin, caryoptin, 3-epicaryoptin, 16-hydroxy epicaryoptin, clerodendrin A, B and C, clerodin, clerodermic acid, cleroinermin, gramisterol, iridoids (inermioside A, B, C and sammangaoside, ugandoside, 8-O-acetylmiosporoside), oleanolic acid, dehydroyolean-one, sesquiterpene (sammangaoside A, B) clerodendrin A, uncinatone, Mi saponins-A, friedelanone and lupeol have been isolated.¹⁷⁻²⁶



Clerodermic acid



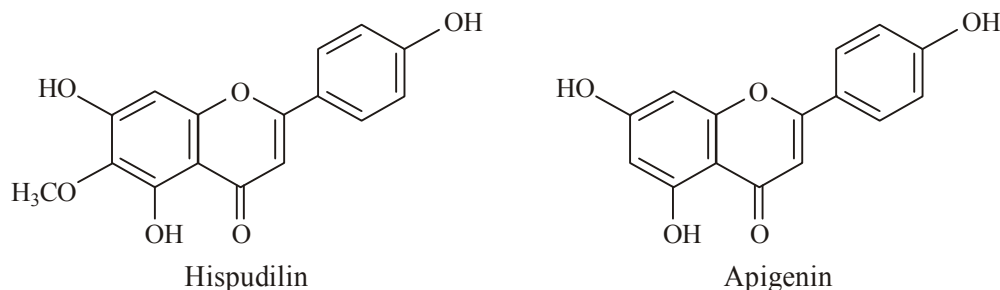
Uncinatone



Iridiod diglucoside

The phenolic profile of the plant revealed the presence of β -benzyl alcohol, β -benzyl alcohol-D-glucoside, neolignan, darendoside-B, phenyl propanoids, vanillic acid, anisic acid, para-hydroxy benzoic acid and gallic acid²⁷. Flavonoids are another class of compounds, which are mainly present in *Clerodendron* species and they are also responsible for few biological activities. The major flavonoids present are cynaroside, 5-hydroxy-4'-7-

dimethoxy methyl flavone, kaempferol, salvigenin, 4-methyl scutellarein, 5,7,4-O-trihydroxyflavone, apigenin, luteolin, acacetin-7-O-glucuronide, hispudulin, 2'-4'-4'-trihydroxy-6'-methyl chalcone, 7-hydroxy flavone, luteolin, naringin-4'-O- α -glucopyranoside, pectolarigenin, cirsimaritin, cirsimaritin-4'-glucoside and quercetin-3-methyl ether, which were isolated from *C. inerme*²⁸⁻³².



Carbohydrates like glucose, fructose and sucrose are reported. Other constituents such as ribosome-inactivating protein, salidroside, jinoside-D and acetoside have also been isolated³³.

Biological activities

Anti-inflammatory activity

Flavonoid glycosides of *C. inerme* showed modulation in calcium transport in isolated inflamed rat liver and thereby showed reduction in inflammation. The results obtained in the experiment were comparable with indomethacine used as a positive control³⁴.

Anti-malarial activity

Clerodendrum has been reported for its antimalarial activities because of the presence of a bitter principle. *C. inerme* also inhibited the growth of larvae of *Aedes aegypti*, *Culex quinquefasciatus* and *Culex pipiens* at 80 and 100 ppm concentration of petroleum ether and ether extracts^{35,36}.

Antioxidant activity

C. inerme has been used as antioxidant drug in various indigenous systems of medicines³⁷.

Antimicrobial activity

Dried, aerial parts of *C. inerme* showed potent antiviral activity against Hepatitis B

virus with an ED50 value of 16 $\mu\text{g/mL}$ ³⁸. Essential oil obtained from leaves of the plant showed antifungal activity against variety of fungal species such as *Alternaria* species, *Aspergillus* species, *Cladosporium herbarum*, *Cunninghamella echinulata*, *Helminthosporium saccharii*, *Microsporium gypseum*, *Mucor mucedo*, *Penicillium digitatum*, *Rhizopus nigricans*, *Trichophyton rubrum* and *Trichothecium roseum*³⁹. Alcoholic extracts of leaves and flowers of *C. inerme* also exhibited antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*⁴⁰.

Antihaemolytic activity

Some researchers reported the antibacterial activity of ethyl acetate extract of *C. inerme* on human pathogens. It is reported for its other biological activity such as antihemolytic effect⁴¹.

Insecticidal properties

The leaf extract of the plant has been shown to contain insecticidal properties against mosquitoes. Various solvent extracts of plant materials have been tested against mosquitoes. Therefore, it was thought rewarding to investigate the dry powder of leaf material as source of insecticidal properties against the mosquito larvae. The effect of sundried leaf powder of *Clerodendron inerme* against fourth instar larvae of *A. aegypti*⁴².

Anti-carcinogenesis activity

Clerodendron inerme is used by Indian traditional practitioners for the treatment of various ailments, including cancer. The *clerodendron inerme* exerts its chemopreventive action by modulating lipid peroxidation and antioxidant defence mechanisms⁴³. Oral administration of aqueous leaf extract of *clerodendron inerme* at a dose of 500 mg/kg body weight significantly prevented the tumor formation and histopathological abnormalities. Oral administration of *clerodendron inerme* protected the levels of blood and tissue lipids, cell surface glycoconjugates, red blood cell osmotic fragility and membrane bound enzyme activity during DMBA induced oral carcinogenesis⁴⁴.

Antifeedants activity

3-Epicaryoptin isolated from the leaves is responsible for growth inhibition and antifeedant activities in housefly and mosquito. Three new neo-clerodane diterpenoids, namely inermes A, inermes B and 14,15-dihydro-15b-methoxy-3-epicaryoptin were found in the hexane extract of aerial parts of *C. inerme*. 14, 15-Dihydro-15-hydroxy-3-epicaryoptin has also been isolated as an epimeric mixture⁴⁵.

Other biological activities

C. inerme extracts showed hypotensive effects in dogs. The methanolic extract of leaf extracts of *C. inerme* showed antispasmodic activity in mouse⁴⁶. Its leaves have been shown to possess antimicrobial activity and are reported to be cardiovascular system active. They also stimulate uterine motility in rats and inhibit intestinal motility. The plant contains mainly iridoids, flavonoids, diterpenes, sterols, triterpenes and neolignans⁴⁷. Organic extracts of *C. inerme* showed strong uterine stimulant activity, when tested in female rats and rabbits⁴⁸ and also showed strong antihemolytic activity in human adults at 0.02-2.0 mg/mL, with inhibition of phospholipase at 0.05-1.5 mg/mL⁴⁹.

CONCLUSION

In this systematic review, the pharmacological studies conducted on *Clerodendron Inerme* indicate an immense potential of this plant as anti-inflammatory, antidiabetic, antimalarial, antiviral, antihypertensive, hypolipidemic and antioxidant activities. The studies indicate that the leaf has important antioxidant activity due to the presence of water-soluble compounds with potent free radical-scavenging effects, such as phenolic compounds that may be associated with lower incidence and lower mortality rates of degenerative diseases in human. In spite of all these activities, very meagre work has been carried out on the chemical, biochemical, pharmaceutical and pharmacological aspects of the plant and hence, extensive investigation especially on its clinical efficacy is needed to exploit its therapeutic utility to combat many diseases. As the global interest towards traditional medicines over the conventional treatment is increasing due to safe and well tolerated remedies provided by them for the chronic illness with lesser side effects, this review targets *Clerodendron inerme* as a potentially safe and effective plant that has important medicinal values and benefits.

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