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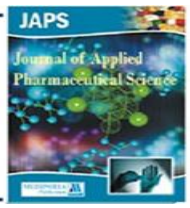


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# *Clerodendrum serratum*: A clinical approach

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**ABSTRACT**

*Clerodendrum serratum* Linn. (Family: Verbenaceae) is very widely distributed in tropical and subtropical regions of the world. Ethno-medicinal importance of the plant has been reported in various indigenous systems of medicines like Ayurveda, Siddha and Unani for the treatment of various life-threatening diseases such as syphilis, typhoid, cancer, jaundice and hypertension. Some of the chief constituents found in the plant are D-mannitol, hispidulin, cleroflavone, apigenin, scutellarein, serratagenic acid, acteoside, verbascoside, oleanolic acid, clerodermic acid, γ-sitosterol, *β*-sitosterol, cholestanol, clerosterol, campesterol and 24-ethyl cholesterol. Traditionally, it has been also used as anti-rheumatic, anti-asthmatic, febrifuge, in cephalagia and ophthalmia. The roots of *C. serratum* are also used as anti-oxidant, anti-bacterial, and anti-fungal. Besides these the antimicrobial value of this herbal plant have also been reported in its stems and leaves. These reports are very encouraging and indicate that herb should be studied more expensively for its therapeutic benefits.

**Keywords:** *Clerodendrum serratum*, anti-oxidant, anti-bacterial, anti-hypertensive, anti-cancer, anti-syphilis.

## INTRODUCTION

According to World Health Organization (WHO), medicinal plants would be the best source to obtain a variety of drugs. About 80% of individuals from developed countries use traditional medicine, which has compound derived from medicinal plants. Therefore, such plants should be investigated to better understand their properties, safety and efficiency. Plants produce a diverse range of bioactive molecules, making them a rich source of different types of medicinal compound; have continued to play a dominant role in the maintenance of human health, since ancient times. Over 50% of all modern clinical drugs are of natural product origin and it also plays an important role in drug development programs in the pharmaceutical industry. Plants are the basic source of knowledge of modern medicine. The basic molecular and active structures for synthetic fields are provided by rich natural sources. This made worldwide interest in medicinal plants reflects recognition of the validity of many traditional claims regarding the value of natural product in health care. Most of the drugs derived from plants were developed because of their use in traditional medicine. India's use of plants for health care dates back close to 5000 years. About 8000 herbal remedies have been codified in the Ayurveda, which is still in use in many dispensaries today (Baker *et al.*, 1995 and Reddy *et al.*, 2001).

***Clerodendrum serratum* Linn.: The Plant**

*Clerodendrum serratum* Linn. is a genus of flowering plants in the Verbenaceae family. Estimates of number of species in *Clerodendrum* vary widely, about 450 (Rahman *et al.*, 2007). The genus is native to tropical and warm temperate regions of the world, with most of the species occurring in tropical Africa and southern Asia, but some in the tropical Americas and northern Australia, and a few extending north into the temperate zone in eastern Asia (Mabberley *et al.*, 2008).

**Fig.** *Clerodendrum serratum* The plant.

**Vernacular names** (Ayurvedic Pharmacopoeia)
*Bengali:* Bamunhatee, Bamanhatee, Bhuijam
*English:* Blue glory, Beetle killer
*Gujarati:* Bharangee
*Hindi:* Bharangi
*Kannada:* Gantubarangee
*Malayalam:* Cheruthekku
*Marathi:* Bharangee, Bharang
*Oriya:* Chinds
*Punjabi:* Bhadangee
*Sanskrit:* Angaravalli, Padma, Brahmanayashtika, Barbura
*Tamil:* Cheruteku
*Telugu:* Ganttubrarangee
*Urdu:* Bharangi, Baharangi

**Taxonomy** (Zipcodezoo, Wikipedia)
*Domain:* Eukaryota
*Kingdom:* Plantae
*Sub-kingdom:* Viridaeplantae
*Phylum:* Tracheyophyta
*Sub-phylum:* Euphyllophytina
*Infraphylum:* Radiatopses
*Division:* Angiospermae
*Class:* Magnoliopsida
*Subclass:* Lamiidae
*Order:* Lamiales
*Family:* Lamiaceae/ Verbenaceae
*Sub-family:* Ajugoideae
*Genus:* Clerodendrum
*Species:* serratum

**Macroscopy**

*Clerodendrum serratum* is a slightly woody shrub with blunty stems and branches. This tree are about 2-8 ft high. It is annual or perennial, usually aromatic (Findmeacure, Ayurvedic Pharmacopoeia, Zipcodezoo).

*Root:* Mature root hard, woody, cylindrical; upto 5 cm thick; external surface light brown having elongated lenticels.

*Stem:* Usually quadrangular (four-angled).

*Bark:* Thin and easily separated from a broad wood which shows marked medullary rays and concentric growth rings in a transversely cut surface; short fractures; acrid taste.

*Leaf:* Leaves usually three at a node, sometimes opposite oblong or elliptic, serrate, alternate without stipules.

*Flower:* Blue, many in long cylindrical thyrsus. They are bisexual, zygomorphic, rarely sub-actinomorphic, bracteolate or not. Corolla with a slender tube,lobe-5, spreading; stamens epipetalous, 4 or 2, free; anther 1 or 2-celled usually dehiscing longitudinally; disc persistent. Ovary superior, 2-celled and each cell 2-ovuled; and style sub-terminal and gynobasic.

*Fruit:* Four lobed purple durpe.

*Seed:* With or without endosperm.

**Pollination**

*Clerodendrum serratum* has an unusual pollination syndrome which avoids self-pollination. This mating system combines dichogamy and herkogamy. The flowers are protandrous. When the flower opens, the stamens stand erect, parallel to the central axis of the flower, while the style bends over, holding the stigma beyond the rim of the corolla. After the pollen is shed, the stamens curl up or bend over, and the style straightens out, bringing the stigma to the center of the flower (Wikipedia).

**PHYTOCHEMISTRY**

The major groups of chemical constituents present in the *Clerodendrum* genus are carbohydrates, phenolics, flavonoids, terpenoids and steroids.

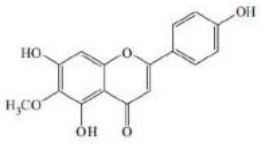
**Carbohydrates**

Generally, D-mannitol have been found in the roots of the plant (Shrivastava *et al.*, 2007).

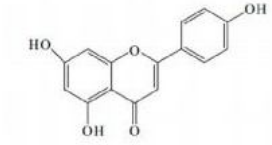
**Flavonoids**

Flavonoids are further sub-grouped into catechins, leucoanthocyanidins, flavanones, flavanonols, flavones, anthocyanidins, flavanols, chalcones, aurones and isoflavones. These isolated flavonoids like hispidulin and cleroflavone possess

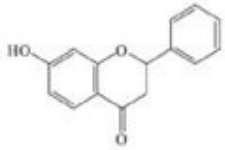
potent anti-oxidant, anti-microbial, anti-asthmatic, anti-tumor and CNS-binding activities. Other flavonoids isolated from plants are apigenin, 7-hydroxy flavanone, scutellareinand pectolinarigenin (Shrivastava *et al.*, 2007; Harbone, 1984; Mann *et al*., 1984).



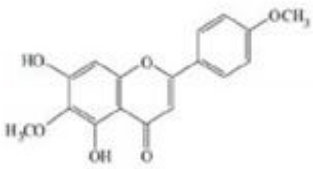
Apigenin



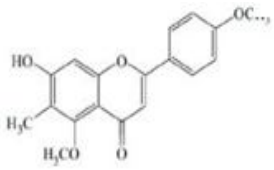
Hipudilin



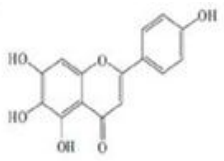
7-hydroxy flavanone



Pectolinarigenin



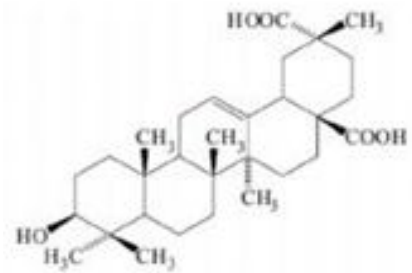
Cleroflavone



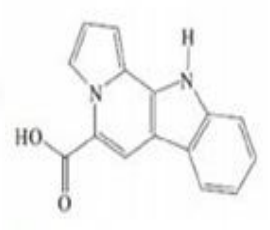
Scutellarein

**Phenolics**

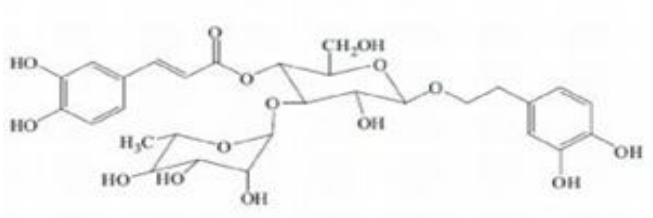
The phenolic compounds in the genus *Clerodendrum* are found in both free as well as bound to sugar moieties. Some of the phenolic compounds isolated were serratagenic acid, acteoside, indolizino and verbascoside which possess biologically activities such as anti-oxidant, anti-microbial, anti-proliferative, anti-hypertensive and anti-cancer activities (Shrivastava N. *et al.*, 2007; Harbone J.B., 1984; Mann J. *et al*., 1984).



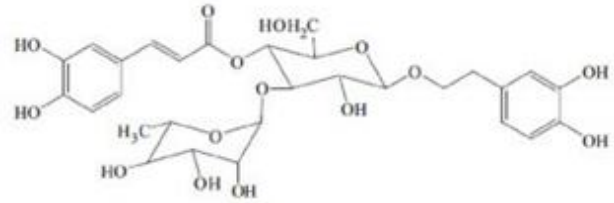
Serratagenic Acid



Indolizion [8,7-B] Indole
5-Carboxlic Acid



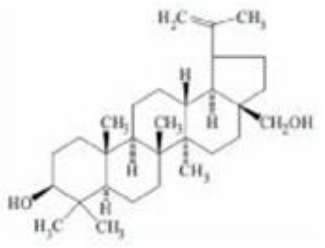
Acteoside



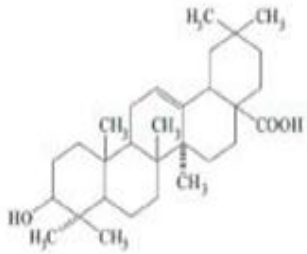
Verbascoside

**Terpenes**

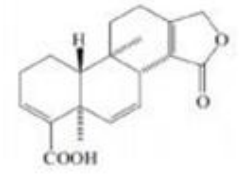
Terpenoids are generally found to be bound to sugar moieties by a glycoside linkage. Usually they are present as glycosides in their β-D-glucosidic form. Some of the terpenes isolated from plant like betulin, oleanolic acid, clerodermic acid, betulinic acid, friedelin and monomelittoside had weak CNS activity, strong molluscicidal and fungitoxic activities (Shrivastava *et al.*, 2007; Harbone, 1984; Mann *et al*., 1984).



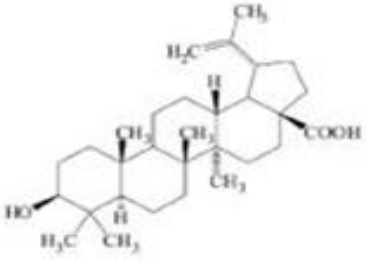
Betulin



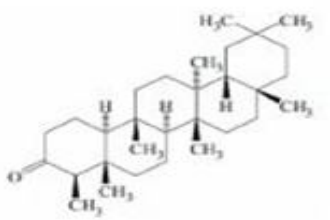
Oleanolic Acid



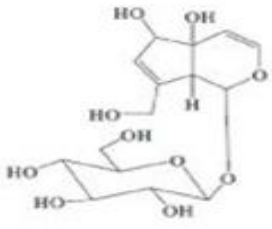
Clerodermic Acid



Betulinic Acid



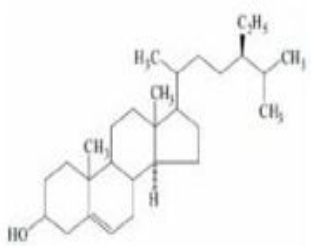
Firedelin



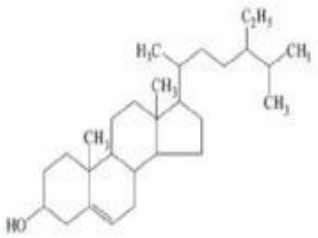
Monomelittoside

**Steroids**

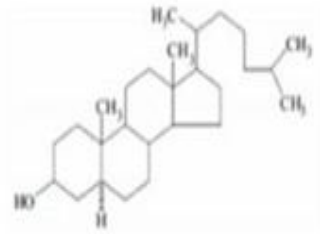
Steroids are terpenes based on the cyclopentane perhydroxy phenanthrene ring. Chiefly, γ-sitosterol, *β*-sitosterol, cholestanol, clerosterol, campesterol and 24-ethyl cholesterol were reported to be isolated from the plant (Shrivastava N. *et al.,* 2007; Banerjee S.K. *et al.,* 1969).



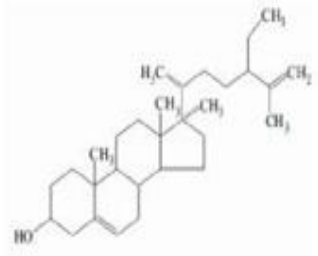
γ–sitosterol



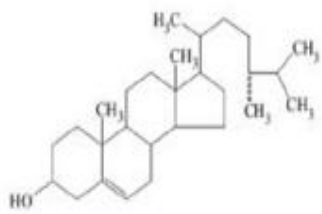
β– sitosterol



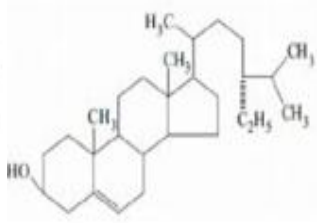
Cholestanol



Clerosterol



Campesterol



24-ethyl cholesterol

**ETHNOMEDICINAL/ TRADITIONAL USES**

- Roots and leaf extracts of *C. serratum* has been used for the treatment of rheumatism, asthma and other inflammatory diseases (Hazekamp A. *et al.,* 2001).
- The roots of the plant have been claimed to be used in dyspepsia, seeds in dropsy and leaves as a febrifuge and in cephalagia and ophthalmia (The Useful Plants of India, 1992).
- Aqueous extracts of leaves of *C. serratum* possess bronchodilator property (Kirtikar K.R. *et al.,* 1992; Steane D.A. *et al.,* 1999).
- Previous studies suggests that apigenin-7-glucoside has demonstrated anti-inflammatory, antimicrobial, hepato-protective and anti-diarrheal properties. The compound also showed significant protection against Alzheimer's disease in mice (Babenko *et al.,* 2008; Havsteen, 1983; Patil *et al.,* 2003; Pareira *et al.,* 2007; Fuchs *et al.,* 1993).

**PHARMACOLOGICAL ACTIVITIES**

**Antioxidant activity**

In DPPH radical scavenging assay, *Clerodendrum serratum* root at various concentrations (50, 100, 150, 200, 250 µg/ml) and ascorbic acid (50, 100, 150, 200, 250 µg/ml) showed the significant inhibitory activity with $IC_{50}$ value 175 and 137 respectively. In reducing power assay, a linear increase in reducing power was observed over the concentration range 20-120 µg/ml sample, equivalent to 20 -120 µg/ml ascorbic acid. The inhibition of 73.32 ± 0.002%, and 64.49 ± 0.242% was observed for ascorbic acid (standard) and ethanolic extract of root (test) respectively at maximum concentrations **(**Bhujbal *et al.,* 2009).

**Anticancer activity**

Aqueous extract and methanolic extract of roots of *Clerodendrum serratum* were screened for *in vivo* anticancer activity using Dalton's Lymphoma Ascites (DLA) cell model at the dose 100 mg and 200 mg/kg body weight. The parameters were analyzed mean survival time, percentage increase in life span, body weight analysis, hematological parameters and biochemical parameters. The study revealed that methanolic extract exhibit significant anticancer activity as compared to aqueous extract. It is used in treatment of fevers, rheumatism and dyspepsia (Zalke *et al.,* 2010).

**Antibacterial activity**

The ethanol extract of roots of the plant have been screened for their antibacterial activity. The extract (7.5 mg/disc) showed broad-spectrum antibacterial activity against gram positive and gram negative bacteria. The results were compared with the standard drug streptomycin (10 µg/disc). The zone inhibition was found to be increased with the increase in concentration of the extract and thus exhibiting concentration dependent activity (Mackei and McCartney, 1996).

**Anti-inflammatory activity**

The ethanolic root extract of *C. serratum* showed significant anti-inflammatory activity in carrageenan-induced oedema in rats, and also in the cotton pellet model in experimental mice, rats and rabbits at concentrations of 50, 100 and 200 mg/kg (Narayanan *et al.,* 1999).

**Wound healing activity**

Ethanolic extracts of roots and leaves of *Clerodendrum serratum* were obtained and their wound healing potency was evaluated on Albino rats. The results shows higher wound healing potancy of root extract as compared to leaf extract (Vidyai *et al.,* 2005).

**CONCLUSION**

This review paper describes the study of the plant *Clerodendrum serratum*. The study focussed on the botany, phytochemistry, ethnomedicinal and pharmacological activities of

the plant. The chemical constituents such as carbohydrates, flavonoids, phenolics, steroids, and terpenes were found. The plant was found to be useful as anti-inflammatory, anti-cancer, hepatoprotective, anti-diarrheal and for its anti-microbial properties. The above data would be helpful in further study of the plant parts and research and development in field of medicine and therapeutic significance.

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