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## Pharmacological review on *Clerodendrum serratum* Linn. Moon

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#### Abstract

*Clerodendrum serratum* is a shrub which is not much branched with stems. The root of the plant is attributed with various activities like anti-inflammatory, digestive and carminative and many more. It is used to treat the conditions like inflammations, anorexia, cough, asthma, hiccough, tubercular glands, skin diseases etc. Various minerals like Na, Mg, Al, Ca etc. saponins, terpenoids, D-mannitol are the phytoconstituents present in the plant. Research works are carried out to study the pharmacognostic, physicochemical, hepatoprotective, anti-oxidant, anti-inflammatory, analgesic, antiasthmatic and various other activities. Clinical trial was also done in patients of *Tamaka shwasa* (Bronchial asthma). Thus, this paper highlights the various pharmacological activities of *Clerodendrum serratum* and its further scope for clinical utility.

**Keywords:** Bharangi, *Clerodendrum serratum*, *Tamaka shwasa*, Anti-inflammatory, Hepatoprotective.

#### 1. Introduction

*Clerodendrum serratum* (Linn.) Moon belongs to the family of Verbenaceae. It is commonly known as Bharangi<sup>[1]</sup> in Hindi, Gujarati, Marathi, Punjabi, Urdu, as Gantu Bharangi<sup>[1]</sup> in Kannada and Telugu, Sirutekku<sup>[1]</sup> in Tamil, Cherutekku<sup>1</sup> in Malayalam, Vamunahati<sup>[1]</sup> in Bengali, Chinda<sup>[1]</sup> in Oriya. In Ayurveda it has synonyms like *Brahmanayashtika*<sup>[2, 3, 4]</sup>, Angaravalli<sup>[2, 3]</sup>, *Phanji*<sup>[2, 3, 4]</sup>, Bhrugubhavaa<sup>[2]</sup>, Gardhabashaaka<sup>[3]</sup>, *Kasaghni*<sup>[3]</sup> and many more. The parts used are the root and leaf.<sup>[5]</sup> Its roots are bitter, acrid, thermogenic, anti-inflammatory, digestive, carminative, stomachic, anthelmintic, depurative, expectorant, sudorific, antispasmodic, stimulant and febrifuge and are useful in inflammations, dyspepsia, anorexia, colic, flatulence, helminthiasis, cough, asthma, bronchitis, hiccough, tumors, tubercular glands, dropsy, consumption, chronic inflammation of the nose, skin diseases, leucoderma, leprosy and fever. Leaves are useful as an external application for cephalalgia, and ophthalmia. The root increases appetite, lessens expectoration. Seeds bruised and boiled in buttermilk are used as aperient and in dropsy.<sup>[5]</sup>

#### 2. Taxonomical identification<sup>[6]</sup>

Domain: Eukaryota  
Kingdom: Plantae  
Sub-kingdom: Viridiplantae  
Phylum: Tracheophyta  
Sub-phylum: Euphyllophytina  
Infraphylum: *Radiatopses*  
Division: Angiospermae  
Class: Magnoliopsida  
Subclass: Lamiidae  
Order: Lamiales  
Family: Lamiaceae/ Verbenaceae  
Subfamily: Ajugoideae  
Genus: *Clerodendrum*  
Species: *serratum*

#### 3. Habitat<sup>[1]</sup>

*Clerodendrum serratum* is more or less found throughout India, in forests upto 1500 metres altitude and globally in Ceylon, Malay, Penninsula.

#### 4. Habit <sup>[7]</sup>

It is a shrub with a height of 0.9 – 2.4 metres, scarcely woody, not much branched with stems bluntly quadrangular. Leaves are often ternate and opposite reaching as much as 28 cms long but usually 12.5 -14 by 5.7- 6.3 cms. They bear the shape of oblong or elliptic with acute tip and coarsely and sharply serrate margin. The base of the leaves is acute and glabrous in texture. Flowers are numerous, showy, in lax pubescent dichotomous cymes, with a pair of acute bracts at each branching and a flower in the fork, each in the axil of a large leafy bract and collectively forming a long lax terminal usually pyramidal erect panicle 15-25 cms long. Pedicels are often twisted so as to make the large lower corolla – lobe appear uppermost and bracts are 1.3 – 3.8 cms long from obovate to lanceolate shaped, pubescent and often coloured. Calyx is 5mm long, puberulous, cup-shaped, truncate. Corolla is glabrous outside, pale blue coloured, the larger lower lobe is dark bluish purple coloured. Drupe is 6mm long, succulent, broadly obovoid, normally four lobed with one pyrene in each lobe.

#### 5. Phytochemistry <sup>[8]</sup>

The minerals reported in the plant were: Na, Mg, Al, K, Ca, V, Cr, Mn, Fe, Co, Ni.

The leaves yielded  $\alpha$ -spinasterol, (+) – catechin, luteolin and luteolin-7-O- $\beta$ -D- glucuronide and flavones namely apigenin, luteolin, baicalein, scutellarein, 6-hydroxyluteolin; a glucoside of 6- hydroxyluteolin; caffeic and ferulic acids; and a mixture of glucose, arabinose and glucuronic acid.

The bark was rich in saponins, which on hydrolysis yielded sapogenin mixture containing three major triterpenoid constituents viz., oleanolic acid, queretaroic acid and a new acid serratagenic acid identified as 3 $\beta$ - hydroxyl- $\Delta$ -oleane-28, 29-dioic acid. The sugars identified were D-glucose, L-rhamnose and D- xylose. The bark also contained  $\beta$ -sitosterol and D-mannitol.

Preliminary studies of root reported the presence of flavonoids, glycosides, saponins, sterols and absence of alkaloids and terpenoids. In another screening, the root showed presence of alkaloids and saponins and absence of tannins.

The root bark contained D-mannitol. Other components identified in root bark were an unidentified saponin and glucose.

#### 6. Pharmacological activity

##### 6.1 Hepatoprotective activity

The ethanol extract of *Clerodendrum serratum* roots and ursolic acid isolated from it were evaluated for hepatoprotective activity against carbon tetrachloride induced toxicity in male Wistar strain rats. The rats received 20 mg/kg/day per orally of ethanol extract and 10 mg/kg/day per orally of ursolic acid concomitantly for 14 days. It revealed that the hepatoprotective activity of constituent ursolic acid extracted from roots of *Clerodendrum serratum* is significant as similar to the standard drug and showed more significant hepatoprotective activity than crude extract (S.M Vidya *et al.* 2005) <sup>[9]</sup>.

Another study was carried out with the aqueous and alcoholic extract of the leaves of *Clerodendrum serratum* at the dose of 200 mg/kg per orally in Swiss albino mice. The results showed significant decrease in liver weight and biochemical parameters like ASAT, ALAT, SGOT, SGPT, ALP, Bilirubin, Total protein compared to control group. Thus the research provides the pharmacological evidence of ethno medicinal

property of *Clerodendrum serratum* in treating hepatotoxicity. (Agarwal *et al.* 2013). <sup>[10]</sup>

##### 6.2 Antioxidant activity

In DPPH radical scavenging assay, *Clerodendrum serratum* root at various concentrations (50, 100, 150, 200, 250 $\mu$ g/ml) and ascorbic acid (50, 100, 150, 200, 250  $\mu$ g/ml) showed the significant inhibitory activity with IC<sub>50</sub> value 175 and 137 respectively. In reducing power assay, a linear increase in reducing power was observed over the concentration range 20-120  $\mu$ g/ml sample, equivalent to 20 -120  $\mu$ g/ml ascorbic acid. In hydrogen peroxide scavenging assay, the inhibitive effect of CSR extract was found to be moderate when compared to other assays. The inhibition of 73.32  $\pm$  0.002%, and 64.49  $\pm$  0.242% was observed in ascorbic acid (standard) and ethanolic extract of root respectively at maximum concentrations. The results of the present study show that the ethanolic extract of the roots of *Clerodendrum serratum* Linn possess antioxidant activity through the DPPH free radical scavenging activity, reducing power assay and scavenging of hydrogen peroxide. (Bhujbal *et al.* 2009). <sup>[11]</sup>

In another study hydroalcoholic extract was prepared from the samples of a polyherbal drug –*Bharangyadi* which contained *Clerodendrum serratum*, *Hedychium spicatum* and *Inula racemosa*. The steroidal and anti- platelet aggregation factor studies were carried out in Swiss albino rats. The results showed that Bharangyadi compound has no endogenous steroidogenesis effect neither it has any role in platelet aggregation inhibition. As no significant change was found in the weight of adrenal gland after two week treatment with the drug, it can be concluded that the anti-inflammatory effect of the *Bharangyadi* compound is not due to increase synthesis of steroids. (Kajaria D K *et al.* 2012) <sup>[12]</sup>.

##### 6.3 Anticancer activity

Aqueous and methanolic extracts of roots of *Clerodendrum serratum* were used to study the anti-cancer activity in Swiss albino mice. Mice were treated with the extracts (100 and 200 mg/kg/day per orally) respectively for 14 days. The parameters studied were mean survival time, percentage increase in life span, body weight, hematological parameters like RBC, WBC and Hb, biochemical investigations viz. ALAT, ASAT, Total protein. The study confirmed that the methanolic extract of the roots of *Clerodendrum serratum* exhibits anticancer activity at the dose of 100 and 200 mg/kg body weight (Zalke *et al.* 2010) <sup>[13]</sup>.

##### 6.4 Antinociceptive activity

Albino mice were used to evaluate the antinociceptive activity with alcoholic extract of *Clerodendrum serratum* roots at the dosage of 50, 100, 200 mg/kg per orally by acetic acid induced writhing and hot plate methods. Morphine sulphate (5 mg/kg, subcutaneously) was used for comparison. The result showed a significant reduction in acetic acid induced writhing, which is indicative of potent antinociceptive effect and further has been supported by hot plate method where a significant increase in AUC (area under the time response curve) was observed. The response was much less when compared to morphine sulphate. (Narayanan *et al.* 1999) <sup>[14]</sup>.

##### 6.5 Anti-inflammatory activity

The alcoholic extract of roots of *Clerodendrum serratum* was administered to Albino rats at the concentration of 50, 100, 200 mg/kg per orally to study the anti- inflammatory activity

by carrageenan induced paw edema and cotton pellet implantation methods. Standard anti-inflammatory agent phenylbutazone (100 mg/kg per orally) was used for comparison in both acute and chronic models. A potent anti-inflammatory effect for *Clerodendrum serratum* was evidenced by the significant reduction in paw edema and cotton-pellet granuloma methods. However, the effect was less when compared to phenylbutazone (Narayanan *et al*, 1999) [14]. In another anti-inflammatory study aqueous extract of *Clerodendrum serratum* root and stem in low (90 mg/kg per orally) and high dose (180 mg/kg per orally) respectively was administered to Albino rats for ten days. The standard group received Dexamethasone p.o as a single dose daily. Both root and stem have shown the anti-inflammatory effect, but root showed significant activity in comparison with Dexamethasone (International Journal of Pharma and Biosciences, 2012) [15].

In yet another study, the methanolic extracts of aerial and root parts of *Clerodendrum serratum* Linn. was carried out to study the anti-rheumatic properties based on the effects on carrageenan induced paw oedema in rats. The results showed that the roots possess significant while the aerial parts exhibited moderate anti-inflammatory activity. Thus from the study it is evident that the roots of *Clerodendrum serratum* L. possesses potent anti-rheumatic properties (Shareef I *et al*. 2013) [16].

#### 6.6 Anti-pyretic activity

Rabbits were treated with the alcoholic extract of roots of *Clerodendrum serratum* (50, 100, 200 mg/kg per orally). Paracetamol 100 mg/kg per orally was used for comparison. The reduction in pyrexia after *Clerodendrum serratum* administration indicated the antipyretic activity of this plant. The response at higher doses was almost comparable to that of paracetamol (Narayanan *et al*, 1999) [14].

#### 6.7 Analgesic activity

In this study analgesic effect of the ethanolic extract of leaves of *Clerodendrum serratum* Linn was evaluated at the dose of 200 and 500 mg/kg by tail flick method and acetic acid induced writhing test in Wistar rats for seven days orally and standard group rats were administered diclofenac sodium (10mg/kg per orally) one hour before study on seventh day. The drug showed significant analgesic activity when compared to standard drug (Saha *et al*, 2012) [17].

#### 6.8 Anti-allergic activity

The present study was screened by milk induced leucocytosis in Albino mice with aqueous extract of *Clerodendrum serratum* root and stem in low (130 mg/kg, p.o) and high dose (260 mg/kg, p.o) respectively for fourteen days. Both root and stem have exhibited anti allergic effect but, only a high dose of *Clerodendrum serratum* root showed significant activity when compared with dexamethasone (International Journal of Pharma and Biosciences, 2012) [15].

In another study, chronic administration of the saponin derived from the plant (20 mg/kg) for three weeks and for six weeks caused a gradual increase in resistance of guinea pigs against antigen egg albumin [18].

#### 6.9 Antifertility

In a preliminary screening, the 50 percent ethanolic extract of the plant (excluding root) showed a spermicidal activity in rats

which was confirmed in the fractionated extract. The extract at two percent showed *in vitro* spermicidal activity in both rat and human semen. In another study, the *n*-butanol soluble fraction of the fifty percent ethanolic extract of the plant (excluding root) also exhibited *in vitro* spermicidal activity in human semen at two percent concentration.

The acetone and methanolic extracts of the root did not exhibit anti implantation activity in rats at 150 mg/kg p.o [19].

#### 6.10 Cholinesterase inhibition

The blood serum of the guinea pigs and rabbits which were treated *in vivo* with the saponin derived from the plant (0.3 mg/kg), exhibited anticholinesterase activity, which was found comparable to that of the standard physostigmine (0.04 mg/kg). Further, *in vitro* studies showed increases in percent cholinesterase inhibition with graded saponin concentration [20].

#### 6.11 Antibacterial

The ether and saline extracts of the leaves exhibited antibacterial activity against *Staphylococcus aureus*, while they were found to be inactive against *Escherichia coli*. The sulphuric acid, acetate buffer and phosphate buffer extracts were inactive against both the bacteria. The 80 percent ethanolic extract of the leaves at 25 mg/ml showed inhibition of *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Bacillus subtilis* [21].

#### 6.12 Antifungal

The aqueous extract of the leaves did not show significant effect on the mycelia growth (8 to 38.2 percent inhibition) of the keratinophilic fungi, viz., *Nannizzia gypsea* (strain -), *N. gypsea* (strain +), *N. incurvata* (strain +), *N. fulva* (strain -) and *N. fulva* (strain +). However, it exhibited antifungal activity against *Curvularia tuberculata*, the causal fungus of die-back disease and *Pestalotiopsis mangiferae*, the causal organism of leaf spot disease [22].

#### 6.13 Antihistaminic activity

The aqueous extract of the root bark (10 to 500 µg/ml) exhibited a graded inhibition of histamine responses on the isolated guinea pig ileum and tracheal chain. The ethyl acetate fraction (0.1 to 1 µg/ml) of the aqueous extract showed inhibition of histamine responses on the guinea pig ileum. The ethanolic extract of the root bark *per se* showed histamine release similar to that effected compound 48/80 in chopped pieces of guinea pig lung. The *in vitro* sensitivity of the rat lung tissue to histamine was diminished after saponin treatment for three weeks while the sensitivity to acetylcholine was not significantly changed. [23]

#### 6.14 Antiasthmatic activity

The anaphylactic bronchoconstrictor response in sensitized isolated guinea pig lung was found to be inhibited after continuous perfusion of the alcoholic fraction of aqueous extract of the root of *Clerodendrum serratum* suggesting antiasthmatic potential [24].

#### 6.15 Mast Cell Stabilization

The saponin derived from the plant caused disruption of mast cells of the rat mesentery and the maximum effect was produced in thirty minutes after which they were was no further increase. The effect was dose dependent [25].

### 6.16 *In vitro* clonal propagation

The present investigation provides a complete *in vitro* process, which is simple, reproducible and efficient for rapid clonal multiplication of an important rare and threatened medicinal shrub, *Bharangi* (*Clerodendrum serratum* Linn. Moon) [26].

### 6.17 Clinical trial

In the above trial, compound formulation- *Kwatha Bharangiguda Avaleha* I and *Bharangiguda Avaleha* II were prepared to study the effect in the management of *tamaka shwasa* (bronchial asthma). Patients of outpatient and inpatient departments irrespective of age, sex, religion were selected. Shwasakastata, Kasa, Pinasa, Kanthodhwamsa, Lalatesweda, Aasinolabhetesukham, were the signs and symptoms for the diagnosis of *tamaka shwasa*. Effect of the drugs was analysed on parameters like WBC count, AEC and ESR, before and after treatment. As per the results of the study, *Kwatha Bharangiguda Avaleha* I was highly significant ( $P < 0.001$ ) in Shwasakastata, Kasa, Kanthodhwamsa, Aasinolabhetesukham and significant ( $P < 0.01$ ) in Pinasa, Lalatesweda. *Bharangiguda Avaleha* II showed highly significant results ( $P < 0.001$ ) in Shwasakastata, Pinasa, Kanthodhwamsa; significant ( $P < 0.01$ ) results in Aasinolabhetesukham and was insignificant ( $P > 0.05$ ) in Kasa. (Gupta A, Prajapati PK. 2011) [27].

### 7. Conclusion

This paper describes the botany, phytochemistry and various pharmacological activities of *Bharangi* (*Clerodendrum serratum* Linn. Moon). Leaves contain glucuronide and flavones; bark has saponins, triterpenoids etc. Root reported presence of flavonoids, glycosides etc. Root bark contained D-mannitol. Further the research studies have proved hepatoprotective, antioxidant, anti-cancer, anti-inflammatory, antinociceptive, analgesic, anti-allergic, anticholinesterase, anti-fungal activities and so on which has further scope for clinical trials to treat the diseases.

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