



Review Article

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PHYTO-CHEMICAL AND PHARMACOLOGICAL PROFILES OF *CLERODENDRUM SERRATUM* LINN. (BHARNGI): A REVIEW

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ABSTRACT

Bharngi is one of the drugs of Ayurvedic materia medica which is mainly indicated in the respiratory disorders. One of the botanical sources of Bharngi is *Clerodendrum serratum* Linn. another species *Pygmaepremna herbacea* is being in use for Bharngi. *Clerodendrum serratum* Linn. (Family: Verbenaceae) is very widely distributed in tropical and subtropical regions of the world. In Ayurveda it is used to cure various disorders like shwasa (breathlessness), kasa (cough), vrana (wound), shotha (swelling) and many vataja disorders (neurological disorders). 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 etc. *C. serratum* is used as an anti-oxidant, anti-bacterial, anti-carcinogenic, hepatoprotective, wound healing, anti-allergic etc. Besides these activities the bronchodilator activity of this herbal plant has also been reported in its leaves.

Keywords: Bharngi, phytochemistry, pharmacological activities.

INTRODUCTION

The medicinal plants have various secondary metabolites in them. Because of these principles they are widely used in the entire world by the people to cure various ailments. Researches are going on to find out the safety and efficacy of each and every component of the drug in different diseases. 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 are still in use. Among them Bharngi is a drug widely used in many disorders due to its various pharmacological activities.

Bharngi botanically identified as *Clerodendrum serratum* Linn. which belongs to the family Verbenaceae is being used since ancient period to alleviate various ailments. The Sanskrit word Bharngi literally means that which is glorious. Another name of the same plant, Bhrguja, implies a relation of the plant with the great sage Bhrgu. In Samhita kala this drug was widely used for many diseases mainly for shwasa (breathlessness), kasa (cough), vrana (wound), shotha (swelling) and many vataja disorders (neurological disorders).

Different synonyms of Bharngi indicate external morphology characters as well as pharmacological activities like Padma (flowers look like that of lotus), Kharashakha (leaf is rough in texture), Bharngi (It destroys the diseases or it is having the power equivalent to sun)¹, Vatari (an enemy of vata dosa)², Kasaghnii (which alleviates cough)³.

Habitat

Clerodendrum serratum Linn. is found more or less throughout India, in forests up to 1500m altitude. It is reported to be rare and endangered in Gujarat⁴.

Habit

Clerodendrum serratum Linn. is a perennial shrubs 0.9 – 2.4 m high. Stem - Scarcely woody not much branched, bluntly quadrangular and young parts are usually glabrous. Leaves - are sessile or nearly so and opposite or sometimes ternate, passing upwards into bracts. 12.52-15 by 5.7-6.3 cm, sometimes reaching up to 28 cm long, narrowly obovate – oblong or sub – elliptic, acute base, acuminate tip, coarsely and sharply serrate margins and glabrous. Petioles are very stout and 6cm long. Flowers - Numerous, 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 leafing bract and collectively forming a long lax terminal usually pyramidal erect panicle 15-25 cm long; pedicels often twisted so as to make the large lower corolla. Bracts – 1.3 to 3.8 cm long, from obovate to lanceolate, pubescent, and often coloured. Fruit is drupe 6 cm long, somewhat succulent, broadly obovoid, dark purple when ripened⁴.

Guna-Karma

Bharngi is pungent and astringent in taste, pungent in the post digestive effect and has hot potency (virya). It alleviates kapha and vata doshas. It possesses light and dry attributes. It is useful in shwasa (breathlessness), kasa (cough), vrana (wound), shotha (swelling) and many vataja disorders (neurological disorders)⁵.

Phytochemistry

In root: Saponins, D - mannitol, Stigmasterol, oleanolic acid, Quercetin, Serratagenic acid, Sitosterol, Clerosterol identified as 5, 25- stimastadien-3 β o, Clerodone as 3 β - hydroxyl- lupan 12- one, B- sitosterol, Lupeol, A steroidal glycoside, Phytosterols, Ferulic acid,

Arabinose, Scutellaricin, Baicalein, Serratin and Ursolic acid.

In leaf: Catchin, α -spinosterol, Luteoline, Polyphenolics, Diterpin – clerodin, Ethycholesta – 5, 24 25- trine 3β - o hispidulin and 7-o- gluconoids of hispidulin and Cruteuarein.⁶⁻¹⁰

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

- Carbohydrates - Generally, D-mannitol has been found in the roots of the plant.
- 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, scutellarein and pectolinarigenin.
- 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, antihypertensive and anti-cancer activities.
- 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.
- 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.¹¹

Pharmacological Activities

Bronchodilator activity

Aqueous extracts of leaves of *C. serratum* possess bronchodilator property.¹¹

Allergic asthma

Icosahydropicenic acid (IHPA), a new pentacyclic triterpenoid saponin was first time isolated from the roots of *C. serratum* (L) Moon (Verbenaceae). IHPA, at the dose of 100mg/kg, showed significant protection of mast cell degeneration (59.62%) as compared to standard sodium cromoglycate (64.48%). The compound also revealed significant inhibitory activity on histamine – induced gout tracheal chain preparation.¹²

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 μ g/disc). The zone inhibition was found to be increased with the increase in concentration of the extract and thus exhibiting concentration dependent activity.¹¹

Wound healing activity

Ethanol 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 potency of root extract as compared to leaf extract.¹¹

Anticarcinogenic activity

The evaluation of the anticarcinogenic activity of the *Clerodendrum serratum* leaf extract (CSLE) on liver and kidney of 7, 12-dimethylbenz[a] anthracene (DMBA) induced skin carcinogenesis in mice were studied. The study showed that there was a recovery in biochemical and oxidative stress parameters in the liver and kidney of the CSLE administered mice. Together, these findings suggest that *Clerodendrum serratum* leaf extract has anticarcinogenic efficacy against skin carcinogenesis.¹³

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.¹¹

Anti-inflammatory and anti-allergic

Anti-inflammatory action in rats was assessed by Granuloma pouch method. The anti allergic activity was evaluated by Milk induced Leucocytosis in mice and Bronchial Hyper-reactivity in Guinea Pigs sensitized with egg albumin.(6 groups, n=6). This study shows that Low Dose (LD) of Bharangi root and High Dose (HD) of stem show anti-inflammatory (23%) and anti-allergic activity (21%) equivalent to Dexamethasone (21%). But the high dose of Bharangi root has promising anti-inflammatory (44%) and anti-allergic activity (35%). Anti-allergic activity is minimal (8.6%) for LD of stem. This study indicates that Bharangi Root is more effective than Stem and its HD would be useful in anti-allergic and anti-inflammatory activity in diseases like asthma; which needs to be further confirmed.¹⁴

The ethanolic root extract of *C. serratum* showed significant anti-inflammatory activity in Carragenin - 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.¹¹

Antioxidant, antiangiogenic and vasorelaxant activities

This study aimed to evaluate the antioxidant, antiangiogenic and vasorelaxant activities as well as the chemical profiles of *C. serratum* leaves extract. The dried powder leaves of *C. serratum* were extracted serially with

petroleum ether, chloroform, followed by methanol and water by maceration method. To elucidate the antiangiogenic properties, the inhibitory effects of these extracts on blood vessel growth formation were adapted in rat aortic ring assay. In another set of experiments, the possible vasorelaxant activity of *C. serratum* leaves extracts were examined on an isolated rat aortic ring preparations and responses of cumulative doses of noradrenalin (NA) were used. Antioxidant activity was evaluated with well-established methods, like 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity and trolox equivalent antioxidant capacity (TEAC) assay. The results showed that, amongst four extracts, methanolic extract of *C. serratum* (ME-CS) showed the most potent antioxidant, antiangiogenic and vasorelaxant activities. On another hand, qualitative study proved that ME-CS contains polyphenolics (hydrolysable tannins and flavonoids), terpenoids, saponins and may not contain any alkaloids. Therefore, while polyphenolics are the predominant compounds found in ME-CS, it is highly probable that they may play an important (dominant) role in antioxidant, antiangiogenic and vasorelaxant activities. Since all the three activities of *C. serratum* extracts end up in the same results, it is likely that, all the activities were contributed by same group (such as polyphenolics) or totally different group of chemical compounds that may act synergistically together with polyphenolics. Polyphenolics are responsible for antioxidant, antiangiogenic and vasorelaxant effects of plants with herbal therapy such as *C. serratum* leaves.¹⁵

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 IC₅₀ 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.¹¹

CONCLUSION

Bhargi (*Clerodendrum serratum* Linn.) is a drug of choice to cure various ailments especially Shwasa (breathlessness), Kasa (cough), Vrana (wound), Shotha (swelling) and many Vataja disorders (neurological disorders) etc. The chemical constituents such as saponin, catchin, olionalic acid, carbohydrates, flavonoids, phenolics, steroids, terpenes etc were reported in

Clerodendrum serratum. Various experiments proved its antiasthmatic, bronchodilator, anti cancerous, hepatoprotective, anti allergic, anti inflammatory, vasorelaxant and wound healing property.

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