

**CLERODENDRUM SERRATUM: BRIDGING TRADITIONAL MEDICINE AND MODERN
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ABSTRACT

Clerodendrum serratum is an important medicinal plant traditionally used in various systems of medicine for the management of respiratory, inflammatory, painful, febrile, and other health disorders. Increasing scientific interest in this species has been driven by its diverse phytochemical composition and its broad spectrum of experimentally demonstrated pharmacological activities. The present review provides a comprehensive overview of the traditional uses, botanical characteristics, phytochemical constituents, pharmacological properties, toxicological profile, pharmacokinetic considerations, and standardization approaches associated with *C. serratum*, with particular emphasis on its potential relevance to modern drug discovery. Phytochemical investigations have identified several classes of secondary metabolites, including flavonoids, phenolic compounds, terpenoids, diterpenoids, triterpenoids, glycosides, steroids, saponins, and other bioactive constituents. Preclinical studies have reported anti-inflammatory, antioxidant, antimicrobial, analgesic, antipyretic, antiasthmatic, antidiabetic, hepatoprotective, neuroprotective, anticancer, wound-healing, and other pharmacological activities. These effects are considered to involve multiple biological pathways, including modulation of inflammatory mediators, oxidative stress, microbial growth, cellular signaling, and tissue-repair processes. Available toxicological evidence suggests a comparatively favorable short-term safety profile for certain extracts and phytochemical fractions; however, comprehensive long-term toxicity, pharmacokinetic, drug-interaction, and clinical safety data remain limited. Similarly, pharmacokinetic characterization and standardized quality-control protocols for *C. serratum* preparations require further systematic investigation. Overall, *C. serratum* represents a promising source of bioactive molecules and standardized phytotherapeutic preparations. Future research integrating phytochemistry, molecular pharmacology, pharmacokinetics, toxicology, omics technologies, and clinical investigation may facilitate the translation of its traditional therapeutic potential into scientifically validated and reproducible medicinal applications.

KEYWORDS: *Clerodendrum serratum*, phytoconstituents, ethnomedicine, pharmacological activities.**INTRODUCTION**

Medicinal plants continue to play a pivotal role in global healthcare, particularly in developing countries where a significant proportion of the population relies on herbal medicines for primary healthcare needs. According to the World Health Organization (WHO), nearly 80% of the world's population depends, at least partially, on traditional medicinal systems for their healthcare requirements. In recent years, increasing concerns regarding adverse drug reactions, antimicrobial

resistance, chronic inflammatory diseases, and the high cost of synthetic pharmaceuticals have accelerated the search for safer and more effective therapeutic agents from natural sources.

Consequently, medicinal plants rich in structurally diverse bioactive compounds have become valuable resources for modern drug discovery and development. Among these medicinal plants, *Clerodendrum serratum* has emerged as a promising pharmacological candidate

because of its remarkable diversity of secondary metabolites and broad spectrum of biological activities. Phytochemical investigations have revealed that the plant contains numerous biologically active constituents, including flavonoids, phenolic compounds, terpenoids, diterpenes, triterpenoids, steroids, iridoid glycosides, saponins, alkaloids, tannins, and essential oils. These phytoconstituents exhibit potent antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, antidiabetic, hepatoprotective, nephroprotective, neuroprotective, and anticancer properties.

During the past two decades, significant progress has been made in elucidating the pharmacological mechanisms underlying the medicinal effects of *C. serratum*. Experimental studies employing in vitro, in vivo, and computational approaches have demonstrated that extracts and isolated compounds from the plant regulate multiple cellular signaling pathways involved in

inflammation, oxidative stress, apoptosis, immune responses, glucose metabolism, and tissue protection. Several studies have reported inhibition of pro-inflammatory mediators such as tumor necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), interleukin-6 (IL-6), cyclooxygenase-2 (COX-2), inducible nitric oxide synthase (iNOS), and nuclear factor-kappa B (NF- κ B). Furthermore, enhancement of endogenous antioxidant defense systems, including superoxide dismutase (SOD), catalase (CAT), and glutathione (GSH), has been proposed as an important mechanism contributing to its therapeutic benefits.

BOTANICAL DESCRIPTION AND TAXONOMY

Clerodendrum serratum (L.) Moon is a perennial medicinal shrub belonging to the family Lamiaceae, although it was previously classified under the family Verbenaceae based on traditional morphological characteristics.

Taxonomic Classification of *Clerodendrum serratum*

Taxonomic Ranking	Classification
Kingdom	Plantae
Subkingdom	Tracheobionta (Vascular plants)
Division	Magnoliophyta (Angiosperms)
Class	Magnoliopsida (Dicotyledons)
Order	Lamiales
Family	Lamiaceae
Genus	Clerodendrum

Vernacular Names

Language	Common Name
Sanskrit	Bharangi, Bhringaraja (regional usage)
Hindi	Bharangi
English	Blue Glory Shrub
Bengali	Bamanhati
Marathi	Bharangi
Tamil	Sirutekku
Telugu	Gantubarangi
Kannada	Bharangi
Malayalam	Bharangi



Fig 1: *Clerodendrum serratum*.

Clerodendrum serratum is an erect, much-branched perennial shrub that typically attains a height of 1–3 m under natural conditions. It grows abundantly in moist deciduous forests, forest margins, grasslands, riverbanks, and hilly regions of tropical and subtropical India. The species prefers well-drained loamy soils with moderate rainfall and partial sunlight but can adapt to a wide range of ecological conditions.

Root

The plant possesses a well-developed woody taproot system with numerous lateral roots. The roots are cylindrical, light brown to greyish-brown externally and cream-colored internally. They are rich in several pharmacologically active phytoconstituents, including diterpenoids, flavonoids, phenolic compounds, and triterpenoids.

Stem

The stem is erect, cylindrical, branched, and woody at the base, while the younger branches remain green and slightly quadrangular. The bark is smooth to slightly rough, pale brown or greyish-brown, and contains numerous lenticels.

Leaves

Leaves are simple, opposite or occasionally arranged in whorls of three. They are elliptic to lanceolate with serrated margins, measuring approximately 8–20 cm in length and 3–8 cm in width. The apex is acuminate, the base attenuate, and the venation is pinnate with prominent secondary veins.

TRADITIONAL THERAPEUTIC APPLICATIONS

Respiratory Disorders

Respiratory ailments represent the most extensively documented traditional indication for *C. serratum*. Decoctions prepared from the roots are administered for the treatment of bronchial asthma, chronic bronchitis, productive cough, allergic rhinitis, pharyngitis, and dyspnea. The plant is believed to act as an expectorant, bronchodilator, mucolytic, and anti-inflammatory agent, thereby facilitating mucus clearance and improving airway function.

Inflammatory and Rheumatic Disorders

In Ayurveda, Bharangi is recognized as an effective Shothahara (anti-inflammatory) herb. Root paste, decoctions, and powdered preparations are traditionally prescribed for rheumatoid arthritis, osteoarthritis, gout, muscular pain, joint swelling, and inflammatory edema.

Gastrointestinal Disorders

The roots are traditionally used to stimulate appetite, improve digestion, relieve constipation, reduce abdominal discomfort, and manage intestinal worm infestations.

Skin Diseases

Leaf paste and root preparations are applied externally for eczema, dermatitis, chronic wounds, boils, ulcers, scabies, and various fungal skin infections.

Urinary Disorders

Traditional medicine recommends *C. serratum* for dysuria, urinary tract infections, renal inflammation, and urinary calculi.

PHYTOCHEMICAL PROFILE OF PLANT

Phytochemical investigations indicate that the roots contain the highest concentration of medicinally important constituents, followed by the leaves, stem bark, flowers, and fruits. These metabolites belong to several major chemical classes, including flavonoids, phenolic compounds, diterpenoids, triterpenoids, steroids, iridoid glycosides, saponins, tannins, alkaloids, lignans, volatile oils, and other specialized metabolites.

Flavonoids

Apigenin, Luteolin, Quercetin, Kaempferol, Rutin, Isorhamnetin (reported in some investigations). Flavonoids exert their biological effects by scavenging reactive oxygen species (ROS), inhibiting lipid peroxidation, suppressing inflammatory mediators such as TNF- α , IL-1 β , IL-6, COX-2, and iNOS, and modulating intracellular signaling pathways including NF- κ B, MAPK, and Nrf2/ARE pathways.

Phenolic Compounds

Gallic acid, Caffeic acid, Ferulic acid, Chlorogenic acid, p-Coumaric acid, Vanillic acid. These compounds protect cellular biomolecules from oxidative damage, inhibit free radical generation, and contribute significantly to anti-inflammatory and hepatoprotective activities.

Triterpenoids

Ursolic acid, Oleanolic acid, Betulinic acid. These compounds exhibit remarkable anti-inflammatory, hepatoprotective, antidiabetic, cardioprotective, and anticancer properties through modulation of oxidative stress, apoptosis, and inflammatory mediators.

Steroids and Phytosterols

β -Sitosterol, Stigmasterol, Campesterol. Plant sterols possess anti-inflammatory, hypocholesterolemic, immunomodulatory, and antioxidant activities and may contribute to membrane stabilization and tissue protection.

Saponins

Saponins present in the roots and aerial parts contribute to several therapeutic properties, including Immunomodulatory activity, Bronchodilatory effects, Antimicrobial activity, Expectorant action.

Alkaloids

Preliminary phytochemical investigations have detected small quantities of alkaloids in different plant parts.

PHARMACOLOGICAL ACTIVITIES OF PLANT

Anti-inflammatory Activity

Clerodendrum serratum has long been recognized in Ayurveda as a Shothahara (anti-inflammatory) medicinal plant and has traditionally been prescribed for the treatment of arthritis, rheumatism, edema, bronchial asthma, chronic cough, musculoskeletal pain, and inflammatory skin disorders. Modern pharmacological investigations have provided substantial evidence supporting these traditional claims by demonstrating significant anti-inflammatory activity in various experimental models. Several in vivo studies have demonstrated that crude extracts and solvent fractions of *C. serratum*, particularly root extracts, significantly reduce experimentally induced acute and chronic inflammation. Ethanolic, methanolic, hydroalcoholic, and aqueous extracts have shown marked inhibition of paw edema in carrageenan-induced rat models, one of the most widely accepted experimental models for evaluating anti-inflammatory agents. The anti-inflammatory efficacy of *C. serratum* has also been demonstrated in histamine-induced, serotonin-induced, dextran-induced, and formalin-induced inflammatory models, indicating that the plant modulates multiple inflammatory mediators rather than acting through a single pharmacological pathway.

Anticancer Activity

Although the precise molecular mechanisms remain incompletely understood, current evidence suggests that the anticancer effects of *C. serratum* may involve multiple complementary pathways which are:

- Induction of apoptosis in malignant cells.
- Inhibition of uncontrolled cellular proliferation.
- Reduction of oxidative stress through antioxidant activity.
- Suppression of chronic inflammation, thereby limiting a tumor-promoting microenvironment.
- Modulation of cell-cycle progression.

Wound Healing Activity

Clerodendrum serratum (L.) Moon has been traditionally used in Ayurvedic and folk medicine for the treatment of wounds, skin infections, ulcers, boils, inflammatory skin disorders, and insect bites. Fresh leaf paste, root preparations, and decoctions have been applied topically to promote wound closure, reduce inflammation, prevent microbial infection, and facilitate tissue repair. Although the plant has a long history of ethnomedicinal use, scientific investigations evaluating its wound-healing potential remain comparatively limited when compared with its anti-inflammatory or antioxidant activities.

The antioxidant properties of *C. serratum* also contribute significantly to wound healing. Phytochemical constituents, particularly flavonoids and phenolic

compounds, neutralize reactive oxygen species (ROS), reduce lipid peroxidation, and enhance endogenous antioxidant enzymes, including superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and reduced glutathione (GSH). By minimizing oxidative damage at the wound site, these compounds protect cellular structures and promote fibroblast survival and extracellular matrix synthesis.

PHARMACOKINETICS AND STANDARDIZATION

For medicinal plants such as *Clerodendrum serratum* (L.) Moon, pharmacokinetic evaluation is particularly challenging because the therapeutic effects are likely to arise from multiple chemically diverse constituents rather than from a single active molecule. The chemical composition of *C. serratum* can vary according to species authentication, plant part, geographical origin, environmental conditions, harvesting season, maturity, post-harvest processing, storage, and extraction procedure. Such variation may lead to significant differences in pharmacological activity between batches.

CONCLUSION

Clerodendrum serratum (L.) Moon is an important medicinal plant with a long history of traditional use and a broad spectrum of experimentally investigated pharmacological activities. The available literature indicates that the plant contains diverse classes of bioactive constituents, including flavonoids, phenolic compounds, terpenoids, diterpenes, triterpenoids, steroids, glycosides, saponins, and other secondary metabolites that may collectively contribute to its biological effects. Pharmacological investigations have reported anti-inflammatory, antioxidant, antimicrobial, analgesic, antipyretic, antiasthmatic, antidiabetic, hepatoprotective, neuroprotective, anticancer, wound-healing, and other potentially therapeutic activities.

The pharmacological profile of *C. serratum* provides a scientific basis for several of its traditional applications, particularly in inflammatory, respiratory, infectious, and pain-associated disorders. However, the majority of available evidence remains derived from in vitro experiments and preclinical animal models, while comprehensive clinical investigations are still limited. Furthermore, considerable variation in plant material, geographical origin, extraction procedures, phytochemical composition, experimental models, and dosage regimens makes direct comparison among studies difficult.

From a drug-discovery perspective, *C. serratum* represents a promising source of pharmacologically active molecules and standardized botanical preparations. Nevertheless, the transition from traditional medicine to evidence-based therapeutic application requires systematic characterization of bioactive constituents, validated pharmacological targets, pharmacokinetic and pharmacodynamic investigations, dose-response evaluation, long-term toxicity assessment,

and well-designed clinical studies. Development of reliable pharmacognostic and phytochemical markers, together with chromatographic fingerprinting and biological standardization, will be essential for ensuring reproducibility and quality of *C. serratum*-derived products.

Overall, *Clerodendrum serratum* possesses substantial pharmacological and phytotherapeutic potential, but its development as a scientifically validated therapeutic resource requires rigorous standardization, mechanistic validation, comprehensive safety evaluation, and clinical confirmation. Such multidisciplinary investigations may facilitate the transition of *C. serratum* from a traditionally valued medicinal plant toward a rationally developed source of novel therapeutic agents and standardized herbal medicines.

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