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Review Paper

Clerodendrum paniculatum Linn. A Comprehensive Review of Phytochemistry and Pharmacological Properties

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ABSTRACT

Clerodendrum paniculatum L., commonly known as the Pagoda flower or Red Glorybower, is a significant medicinal plant species belonging to the Lamiaceae family. This review synthesizes current knowledge about its botanical characteristics, geographical distribution, phytochemical composition, and therapeutic applications. Native to tropical Southeast Asia, this semi-woody shrub is characterized by its distinctive orange-red flowers and large evergreen leaves. Phytochemical analysis has revealed the presence of various bioactive compounds, including phenolics, flavonoids, alkaloids, terpenes, steroids, and glycosides. Traditional medicine systems across Asia have utilized different parts of the plant to treat various conditions, including rheumatism, inflammation, wounds, and women's health issues. Modern pharmacological studies have demonstrated multiple therapeutic properties, including antioxidant, hepatoprotective, anti-inflammatory, antibacterial, anticancer, and antidiabetic activities. The plant's antioxidant properties are attributed to its high flavonoid and phenolic content, while its anti-inflammatory effects are linked to the reduction of pro-inflammatory cytokines and mediators. Additionally, research has shown promising results in its potential as an insecticidal and anthelmintic agent. While *C. paniculatum* has demonstrated significant therapeutic potential across various applications, further clinical research is needed to fully validate its traditional uses and explore its potential in modern pharmaceutical development. This comprehensive review highlights importance of plant in both traditional medicine and contemporary therapeutic applications, suggesting its potential value in future drug development initiatives

INTRODUCTION

A significant amount of the global drug market is made up of plant materials, which are utilized as

over-the-counter medications, home cures, and pharmaceutical industry raw materials in both developed and developing nations [1]. The plant

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species *Clerodendrum paniculatum* L. (*C. paniculatum*) belongs to the genus *Clerodendrum* [2]. The genus *Clerodendrum* includes subherbaceous perennials, lianas, small trees, and shrubs [3]. The plant is a member of the Verbenaceae family, which is now part of the Lamiaceae family [4]. Other popular names for it are Red Bleeding Heart, Pagoda flower, and Red Glorybower. Numerous nations, including India, Laos, Cambodia, Thailand, Indonesia, and Vietnam, are home to *C. paniculatum* L. [5]. The plant is either biennial or annual [6]. The plant thrives in bushes and on the slopes of mountains. Few people are aware of its amazing properties, but it is a valuable herb in traditional medicine. For thousands of years, traditional medicine has employed numerous species from the genus *Clerodendrum* to treat a wide range of illnesses and metabolic conditions in people [2]. The plant bears enormous orange-red or scarlet flowers that are held above its big evergreen leaves [7]. It grows in rocks and can be found in the Andaman and Nicobar Islands. Tribes in the Andaman and Nicobar Islands utilize the plant as an abortifacient [4]. It is used as a medication to treat renal issues, gonorrhoea, urinary tract issues, and painful eyes. Preliminary phytochemical screening revealed the presence of terpenes, flavonoids, tannins, alkaloids, phenolic acids, sterols, and glycosides.

The herb has great medicinal value and is used to cure skin diseases, pitta wounds, vitiated vata, and inflammatory ulcers. A root decoction is used as an aching and pain tonic. In India, China, and Japan, it has long been used to treat rheumatism, neuralgia, ulcers, inflammation, and wound healing [8]. It has been utilized as an antipyretic and anti-inflammatory medication in traditional Thai medicine [7]. This plant is also used to cure wounds, snake bites, bodily aches, jaundice, and eye pain in Iceland and Indonesia. Furthermore, leukorrhoea, vaginal discharge, irregular menstruation, uterine irritation, and a number of other women's disorders are treated with *C. paniculatum* [5]. *Clerodendrum paniculatum* is a common plant in Udupi district of Karnataka, India. The genus, which includes small trees, shrubs, and plants, is well-known for its decorative use [7]. In the genus *Clerodendrum*, more than 550 species are reported to be identified. There are over 550 species known to exist in the genus *Clerodendrum*. With over 580 species recognized, *Clerodendrum* is a fairly vast and diverse genus that is found all over the world [6]. Rajendran and Daniel recorded 23 species in India, with Srivastava and Choudhary recording 16 of those species from Arunachal Pradesh. They thrive in rainforests with waste water, frequently near freshwater [7].



Fig No. 1: *Clerodendrum paniculatum* plant



Fig No. 2: Morphology of *Clerodendrum paniculatum* a) Flower b) Leaves

Scientific Classification [9]

Table No. 1: Scientific classification of *Clerodendrum paniculatum*

Taxonomic Rank	Classification
Kingdom	Plantae
Class	Dicotyledones
Order	Lamiales
Superorder	Asteranae
Family	Lamiaceae
Domain	Eukaryote
Phylum	Spermatophyta
Subphylum	Angiospermae
Genus	<i>Clerodendrum</i>
Species	<i>Clerodendrum paniculatum</i>

Vernacular Names [10, 11]

Table No. 2: Regional names of *Clerodendrum paniculatum* in different languages

Language	Regional Name(s)
English	Pagoda flower, Orange Tower Flower
Tamil	Krishna kireedam
Kannada	Ratha pushpa, Ratha hoo
Malayalam	Hanuman kireedam, Krishna kireedam
Malay	Pangil pangil
Sanskrit	Krishna kireeta

Geographical Distribution

With almost 500 species, the genus *Clerodendrum* L., which was formerly a member of the

Verbenaceae family, is now a member of the Lamiaceae family. The genus *Clerodendrum* L. is found worldwide in tropical and subtropical areas. Because of the terminal panicles' striking orange-red to crimson flowers, it is primarily grown as an ornamental plant in gardens. It can be found all across tropical Southeast Asia, including Bangladesh, Indonesia, China, Taiwan, Laos, Cambodia, Vietnam, Malaysia, Sri Lanka, and India. Southern China, including Taiwan, Indochina, Bangladesh, Sri Lanka, Andaman & Nicobar Islands, Borneo, Sulawesi, Sumatra, the Philippines, and the Bismarck Archipelago, is where it originated [5,12,13].

Description Of the Plant

The shrub *C. paniculatum* L. is upright and semi-woody. The plant is roughly 2.5 meters tall, has many branches, and is 0.6 to 0.9 meters wide. Huge orange-red or scarlet blossoms are held above the plant's massive evergreen leaves. The plant is firmly supported by the large, sturdy roots, which have a fibrous, branching structure. The roots' vascular cylinder and cortex are both well-developed anatomically, and their many root hairs increase their surface area, which facilitates effective water and nutrient absorption. The bases of the leaves are heart-shaped; the upper leaves are whole, while the lower leaves are lobed. The leaves have a maximum diameter of 30.5 cm. They have shallow lobes, are cordate-ovate, three to seven lobed, and are membrane-bound. The

petiole is up to 30 cm long with an acuminate tip, and the leaf margins are glandular underneath and minutely denticulate. Large terminal panicles hold the flowers in place. The calyx is separated almost to the base and ranges in colour from red to orange-red. The lobes are around 7 mm long, and the corolla is orange-red to crimson with a thin tube up to 2 cm long. Almost all year long, flowers are produced. The fruit is round, bluish-black, drupe-shaped, and about 1 cm in diameter [7,10].

Phytoconstituents

Clerodendrum L. members have been shown to contain a wide variety of phytochemicals, with over 280 phytochemicals from various *Clerodendrum* species having been reported. Phenolics, steroids, di and tri terpenes, flavonoids, alkaloids, tannins, sterols, glycosides, volatile oils, oleanolic aldehyde acetate, β -sitosterol, lupeol, stigmasta-4,25-dien-3-one-22E-stigmasta-4,22,25-trien-3-one, and 3 β -stigmasta-4,22,25-trien-3-ol are among the chemical components

reported from the genus. The roots of *C. paniculatum* provide chemicals such as β -amyryn, β -sitosterol, and (24s)-ethylcholesta-5,22,25-triene-3 β -ol. Glycosides, alkaloids, reducing sugars, carbohydrates, tannins, flavonoids, quinones, terpenoids, diterpenoids, phenols, rutin, quercetin, phytosterols, coumarins, and amino acids were all present in the leaves of *C. paniculatum*. The phytochemical screening of the flower extract showed the presence of proteins, steroids, flavonoids, phenolics, carbohydrates, and tannins. Several chemicals, including alkaloids, glycosides, carbohydrates, flavonoids, saponins, tannins, protrins, and phenols, were found in the stems of *Clerodendrum paniculatum* after phytochemical screening. Terpenes were also reported, including glutinol, poriferasta-5,22E, triacatane, clerodin, clerodendrin A, 3 β -acetylloleanolicacid, 3 β -acetylloleanolic aldehyde, and 25-trien-3 β -ol [12-15].

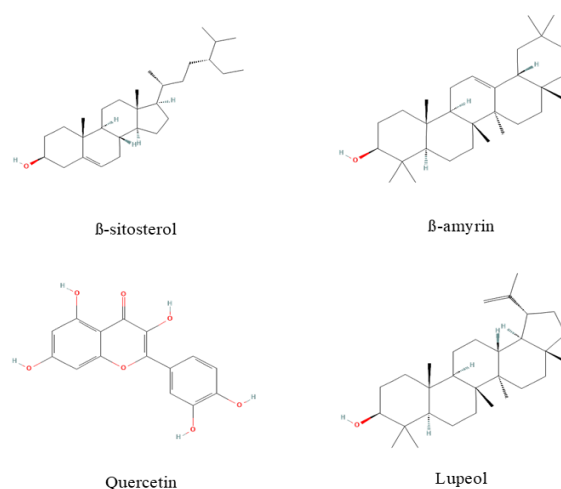


Fig No. 3: Representative Chemical Structures of Phytoconstituents in *Clerodendrum paniculatum*

Medicinal Uses

Multiple *Clerodendrum* species have been documented to have ethnomedical value in a variety of indigenous medical systems and as folk remedies. According to reports, several species of *Clerodendrum* have anti-inflammatory, anti-diabetic, anti-cancer, and anti-malarial qualities. The leaves, roots, and other parts of *Clerodendrum*

paniculatum are said to have anti-oxidant, anti-inflammatory, hepatoprotective, and anti-diabetic properties. Particularly in the Indian, Chinese, Thai, Korean, and Japanese medical systems, the species is used as medicine to treat a number of serious illnesses, including cancer, syphilis, typhoid, jaundice, and hypertension. It has been stated that the powder/paste form and the different

extracts of roots, stems, and leaves are used as medications to treat lung, blood, skin, and asthma conditions as well as cataracts, malaria, and other conditions. Laxative, diuretic, analgesic, anti-inflammatory, anti-tumor, and antibacterial properties have all been documented for the roots [1,12,16].

Pharmacological Activities

Anti-oxidant activity

With an IC₅₀ value of 64.898 ppm for the pagoda flower ethanol extract and 27.73376 ppm for the pagoda leaf extract, these two extracts exhibit high antioxidant activity [17]. Phytochemical examination of the floral extract revealed the presence of proteins, steroids, flavonoids, phenolics, carbohydrates, and tannins. The primary markers of antioxidant activity in herbals are thought to be the presence of flavonoids and phenolics [18].

Hepatoprotective activity

The presence of glyceric acid, gallic acid, pilocarpine, pangamic acid, and quercetin, either separately or in combination, may be responsible for the hepatoprotective properties of *C. paniculatum* flowers, according to analyses [18].

Anti-inflammatory activity

By lowering the release of pro-inflammatory cytokines (TNF- α) and inflammatory mediators (NO, PGE₂), the root extract of *C. paniculatum* demonstrated anti-inflammatory potential [19]. The traditional applications of leaves of *Clerodendrum paniculatum* Linn. in inflammation have been scientifically supported by another study, which found that the leaves' strong anti-inflammatory properties are caused by the presence of terpenoids and flavonoids [20]. At 50 mg/kg, *C. paniculatum* leaf ethanol extract also has anti-inflammatory properties [17].

Mutagenic and anti-mutagenic effect

According to a study, *C. paniculatum* root extract was non-mutagenic and could prevent *S. typhimurium* strains TA98 and TA100 from

becoming mutagenic when exposed to a nitrite-treated 1-aminopyrene mutagen [19].

Anti-bacterial activity

The powdered samples of *C. paniculatum* leaves and flowers have good qualitative and quantitative characteristics that support prolonged shelf storage and the extraction of bioactive phytochemicals, according to proximate analysis. Due to the high concentrations of flavonoids and polyphenols in the plant extracts, the extracts of both plant sections demonstrated strong concentration-dependent antibacterial activity against *B. subtilis* and *E. coli* [5].

Anticancer activity

The ethanolic extract of roots of *Clerodendrum paniculatum* showed anti-cancer activity by using liquid tumor model but to a lesser extent. The extracts decreased the tumour volume in solid tumour model and that result was not that much significant compared to standard cisplatin. The concentration dependent scavenging of DPPH, ABTS, and O Phenanthroline were studied with the concentrations of 2 μ g/ml to 1024 μ g/ml. several antioxidant phenolic compounds have been recognized to have ability to induce apoptosis in various tumour cells of human origin. [7]

Anti-diabetic activity

According to a study, phytochemicals including flavonoids, alkaloids, phenolic compounds, tannins, terpenoids, glycosides, saponins, carbohydrates, amino acids, and proteins are what provide *Clerodendrum paniculatum* leaf chloroform extract its strong anti-diabetic properties [21].

Insecticidal activity

The insects *Helicoverpa armigera* and *Spodoptera litura* were screened for insecticidal activity. It was evaluated using crude ethanolic extracts of *Clerodendrum paniculatum* leaves. The antifeedant assay, growth inhibitory assay, and larval mortality assay are the methods utilized to conduct analysis. The extract demonstrated



insecticidal efficacy that was moderately dosage dependent [22].

Anthelmintic activity

Praveen et al. measured how long it took for the earthworm *Eudrilus eugeniae* to become paralysed and die after being exposed to different solvent extracts of *C. paniculatum* leaves. Furthermore, compared to aqueous, chloroform, and ethyl acetate extracts, the study found that the methanol extract has notable activity [23].

CONCLUSION

Clerodendrum paniculatum Linn. is widely used in both traditional and modern medicine due to its decorative and therapeutic qualities. Its pharmacological potential is highlighted by its extensive phytochemical profile, which includes flavonoids, alkaloids, and phenolic chemicals. The plant is a prime example of nature's extensive medicinal store, with uses ranging from anti-inflammatory and hepatoprotective to antibacterial and antioxidant qualities. Despite its wide range of traditional applications, more thorough investigation is necessary to support its therapeutic claims and investigate novel drug development opportunities, especially in clinical trials. By bridging ethnobotanical knowledge and scientific investigation, *Clerodendrum paniculatum* Linn. emerges as a promising candidate for future pharmaceutical advancements.

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