



A Comprehensive Review on Medicinal Plant of *Celastrus Paniculatus* Wild, Using Phytochemicals and Pharmacological Activities

Gautam SK*

Department of Pharmacy, Central University of Rajasthan, India

*Corresponding author: Surendra Kumar Gautam, Department of Pharmacy, Central University of Rajasthan, Ajmer, India, Email: surendra_bkt95@yahoo.in

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Abstract

Celastrus paniculatus Wild (*Celastraceae*) is one of the most important medicinal plants in Ayurveda. *Celastrus paniculatus* plant extracts and their bioactive compounds have been utilized extensively for various medical purposes. It is used for pharmacological benefits such as anti-depressants, antibacterial, anti-arthritic, anti-fertility, antimalarial, wound healing, analgesic, cardiovascular, anti-inflammatory, neuro disorder, anxiolytic, anti-spasmodic, antidiabetic, anticancer, antioxidant and skin diseases. The various phytoconstituents derived from the plant include alkaloids, flavonoids, terpenoids, steroids, and fatty acids. They isolated from the plant, including malkanganin, paniculatin, beta-sterol, and celapanin. Further, CP plant extract can treat neurological disorders.

Keywords: *Celastrus Paniculatus*; Traditional Medicine Plant; Phytochemicals; Pharmacological Activities

Abbreviations

CP: *Celastrus Paniculatus*.

Introduction

Celastrus paniculatus (CP) plants are used to treat diseases, and they are also a common name for plants, i.e., Jyotishmati, Malkanguni, and Intellect Tree. It belongs to the *Celastraceae* family, as shown in Figure 1 [1]. CP plants are found in India, Indonesia, Laos and the Andaman Islands. Globally, the herbal medicine market exceeds \$60 billion annually. The revenue for the herbal medicine market in the US,

Australia, and Canada reached around US\$ 30 billion in 2000 and subsequently surged by roughly 5-15% by the new millennium [2]. CP has been harvested in the Himalayan region during October and November [3,4]. In Traditional medicines, Ayurvedic medicine such as Unani and Siddha has employed the plant CP to treat numerous illnesses such as paralysis, skin conditions, depression, leprosy, asthma, fever, and arthritis [4]. The leaves are measured at 14 to 15 mm in width and 18 to 20 mm in length, with normocytic stomata. In a microscope, three palisade cells are visible within a single leaf cell. Microscopic analysis reveals the presence of xylem, sclerenchyma, parenchyma, collenchyma, and mesophyll in CP leaf powder [5,6].



Figure 1: *Celastrus paniculatus* Tree.

General	Botanical name
Scientific name	<i>Celastrus paniculatus</i>
Family	Celastraceae
Kingdom	Plante
Geneus	Celastrus
Order	Celastrales
Species	Paniculatus
Common Name	Malkagni, Black-oil tree

Table 1: Taxonomical Classification.

Flower

The panicles, which are 5–15 cm long and yellowish green, bear terminal, pendulous, unisexual flowers. The petal is 3mm long, oblong in shape, has pubescence on the outside, and features semi-orbicular, ciliate lobes with a rounded apex. Male flowers possess stamens with short filaments and oblong anthers, 2 mm long, located on the disc margin, and a minute, subconical, slightly 3-toothed ovary. Female flowers possess a globose-shaped ovary, a short, thick style with a three-lobed, glabrous stigma, stamens situated on the disc's edge (more prominent than in male flowers), and small, acute or subtriangular anthers lacking pollen, measuring less than 1mm in length. 9-12 mm in diameter, bright yellow, transversely wrinkled three-valved, three-celled capsules expand after dehiscing and remain connected at the base to reveal the seeds [1,7,8].

Roots

The roots enhance fertility and relieve intense menstrual pain. CP root bark contains n-triacontanol, pristine in, benzoic acid, unidentified quinine, and golden-yellow oil, which are extracted using petroleum ether or chloroform. The outer root bark contains quinone, phenolic triterpenoids, and celastrol [7]. The powdered root bark of CP is used as a laxative to clear the digestive tract and as a brain tonic for depression swooning, rheumatism, and tumor therapy [9].

Leaves

Malkangani leaves contain alkaloids, glycosides, and coloring material, providing a powerful antidote for opium poisoning [10]. The plant *Celastrus* comprises sterols, alkaloids, and vivid pigments. These are isolated compounds from leaf extracts such as celapagine, celastrine, celapanigine, celapanine, and paniculatine, which are significant alkaloids. Most of the oil content includes oleic acid, with a substantial presence of linoleic acid, palmitic acid, and stearic acid [11,12]. Three novel sesquiterpene alkaloids have been identified: celapanin, celapanigin, and celapagin [13]. three known compounds (angulateoid C, 1,6,8,14-tetraacetoxy-9-benzoyloxydihydro-agarofuran, and 1,6,8,9-triacetoxy-9-benzoyloxydihydro-agarofuran) and one new sesquiterpene categorized as in $1\alpha,6\beta,8\beta$ -triacetoxy- 9β -benzoyloxydihydro- β -agarofuran [14].

Phytochemical Constituents

Several components were identified through phytochemical screening examinations of CP leaf and seed extracts. The aqueous extract uniquely comprises phenolic compounds, flavonoids, tannins, fixed oil, alkaloids, amino acids, phenolic compounds, carbohydrates, glycosides, proteins, and saponins, as shown in Table 2. At the same time, sterols and triterpenoids are common in both the aqueous and ethanolic extracts [15,16].

Secondary metabolites: Alkaloids are present in the leaves, while celapanin, celapanigin, celapagin, celastrine, and paniculatine are prominent secondary metabolites found in the extracted seed oil. Malkangunin, a sesquiterpene ester, was isolated from the CP plant's methanolic extract, along with the sesquiterpene alkaloids celanin, celapanigin, and calpain. In Ayurvedic medicine, the seed oil extracted from CP is used for healing intestinal issues and promoting muscle relaxation [12,17]. The investigations established that the isolated bioactive compounds from the genus '*Celastrus* comprise sesquiterpenes (β -agarofurans), diterpenes, triterpenes, alkaloids, and flavonoids, highlighting β -dihydroagarofuran, sesquiterpenes, and triterpenes as the significant active components are shown in Table 2 [18].

Classes	Phytoconstituents	References
Alkaloids	Paniculatine, Celapanin, Celapanigin, Celapagin, Celastrine, Maymysine	[7,12, 19,20]
Monoterpenes	Linalool, trans-carveol	[21]
Sesquiterpenes	Malkanguniol, Malkangunin, Angulatueoid C, Eudalene, Celastrol	[7,20,22,23]
Diterpenes	Isophytol	[21]
Triterpenes	Lupeol, Paniculatadiol, Zeylasteral	[21, 24]
Flavonoids	Paniculatin	[25]

Table 2: Classes of Major Phytochemical Constituents.

Pharmacological Activity

Jyotishmati, or CP Wild (*Celastraceae*), is a significant therapeutic plant in Ayurvedic medicine. The medicinal properties of CP encompass anti-arthritic, hypolipidemic, antioxidant, anti-fertility, analgesic, anti-inflammatory, and cardiovascular effects.

Anti-Inflammatory and Analgesic Activity: The methanol extract of the flower of CP was screened for anti-inflammatory and analgesic activity using a carrageenan-induced paw edema model. The result revealed that both activities were orally administered to the carrageenan-induced rat paw edema. The inhibition of inflammation was shown at 66.60% and 78.78% by seed oil in doses 5ml/kg and 10ml/kg compared to ibuprofen at 75.75%, shown by 100ml/kg dose [26].

Antioxidant: The methanolic, ethyl acetate, petroleum ether, and aqueous extracts of CP screened for antioxidant activity. In DPPH, reducing power, NO, and Cupric ion reduction were used to assess antioxidant activity. The results revealed that the lowest IC₅₀ of ethyl acetate extract (585.58g/ml) was shown in the DPPH assay. The IC₅₀ values for the Methanol, aqueous, ethyl acetate, and petroleum ether extracts in the nitric oxide scavenging assay were 320.54g/ml, 122.99g/ml, 601.81g/ml, and 206.37g/ml, respectively, compared to 6.83g/ml for the reference ascorbic acid extract. The extracts have identified the potential antioxidant activity [27].

Wound Healing Activity: The isolated compound (lupeol) from petroleum ether extract of leaves of CP for examined wound healing activity using Swiss albino rats. The lupeol was treated with wound healing was significant (17.837 ±0.48), and the standard drug of nitrofurazone (18.337 ±0.42). Wound-healing capabilities of lupeol extracted from CP leaves (175-225 g petroleum ether extract) were assessed using excision, incision, and dead space wound models on Swiss Albino rats. The incision wound epithelialization was faster with the high rate of contraction (571.50 ±75.07) compared to control, and dead space indicated the increase of collagenation and absence of monocytes [28].

Antibacterial: The crude ethanol extract of CP and isolated the sesquiterpene derivative phytoconstituent (celapanin) was screened against 30 Gram-positive *Staphylococcus*

aureus clinical strains. The result revealed that the ethanol extracts exhibited the zone of inhibition against clinical strains of pneumonia (13.58 ± 0.22 mm), *P. aeruginosa* (13.10 ±0.29 mm), and *S. aureus* (22.18 ± 0.30 mm). The activity of celapanin was compared to ciprofloxacin (50 µg/100 µL) [29].

Anti-Fertility Activity: The ethanolic extract from the seed of CP was examined in adult male rats to evaluate antifertility effects. The results revealed that the aqueous extract was administered in oral dose (250 mg/kg) by oral route for 45 days. The significant inhibition of spermatogenesis was decreased reproductive organ weight (p<0.05) and measured to the epididymal sperm count and motility. The sorbitol dehydrogenase activity was significantly reduced (p<0.05) [30].

Cardiovascular: The seed oil was orally administered as an emulsion (50-100 mg/kg b.wt), causing a fall in cardiac output, bradycardia, and a significant increase in pulse rates in the cat. Similarly, 1g of emulsified oil had a comparable effect in dogs. The results revealed that the aqueous extract exhibited 50% ACE inhibition of seed of CP; ethanol extract showed the lowest activity, while acetone extract had no inhibitory effect [31].

Anti-Arthritic Activity: In this study, the alcoholic and petroleum ether of CP seed was assessed in Wister albino rats. The petroleum ether and alcoholic extracts were used to manage the arthritic effects. The results revealed that the seed of CP is endowed with anti-arthritic effects [32].

Antimalarial: In vitro antimalarial activity of *Celastrus paniculatus* was assessed using root, bark, and stem extracts. The extract from the root bark's chloroform portion showed the most potent antimalarial activity. The active ingredient in the chloroform fraction was identified as pristimerin, a quinonoid triterpene. The antimalarial activity of pristimerin was inferior to standard medications against multidrug-resistant strains of *P. falciparum* in vitro tests [33].

Conclusion

Indian traditional medicine recognizes *Celastrus paniculatus* for its various therapeutic applications and minimal adverse effects. This review encompasses traditional uses, chemical

compositions, and pharmacological effects on memory enhancement or nervous system support. Traditional uses include epilepsy, paralysis treatment, rheumatism relief, leprosy management, bacterial infection control, and wound healing. The seeds of CP have been reported to possess anti-arthritic, antioxidant, hypolipidemic, iron chelating, nootropic, and cognitive enhancement properties, which can be attributed to various extracts containing melanin, celapagine, celapanigine, β -amyryn, β -sitosterol, stigmasterol, malkanguinol, malkangunin, and paniculatadiol. A limited number of activities are mentioned about extracts from leaves, roots, and flowers. Further investigations into CP other constituents are crucial due to their presence of beneficial active compounds like n-triacontanol, pristine in, benzoic acid, quinine, golden yellow oil, celastrol, zeylasterone, phenolic triterpenoids, and tannins. This review will encapsulate the scientific findings on *Celastrus paniculatus*.

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