

# Traditional, Ethnomedical, and Pharmacological uses of *Celastrus paniculatus*: Review

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## Abstract

The medicinal plants are playing a pivotal role in the modern medicine; especially in the treatment of different human ailments. Bioactive factors derived from the plants remain the basis for a large proportion of the commercial medication. *Celastrus paniculatus* (CP) is one such a traditional ayurvedic medicinal plant used for centuries as a memory enhancing, anti-inflammatory, analgesic, sedative, antiepileptic, antioxidant, wound healing, anxiolytic activities, enhancement of learning and memory, hypolipidemic effects, and other pharmacological agents. The various extracts of CP have been extensively investigated in several laboratories for their neuropharmacological effects, and a number of reports are available confirming their nootropic action. The Jyothismathi oil obtained from the seeds of CP, widely used in the indigenous system of medicine for the treatment of brain-related disorders. Keeping in the view of the therapeutic potential of this plant, investigations are being continued to design novel drugs for many ailments from this versatile medicinal plant.

**Key words:** Bioactive constituents, *Celastrus paniculatus*, ethnomedical use, pharmacological properties, traditional use

## INTRODUCTION

From days unknown the plants are being used for the treatment of different human ailments; especially medicinal plants either as crude extracts or as pure compounds, which provide unlimited opportunities for the discovery of new drug candidates because of their chemical diversity and bioavailability. *Celastrus paniculatus* Wild. (CP) is one of the important medicinal plants known for its ability to improve memory.<sup>[1]</sup> Ayurveda, the ancient traditional medicine system has been used this plant for the treatment of various diseases. This plant has a remarkable reputation in the treatment of cognitive dysfunction, nervous system disorders and as a brain tonic.<sup>[2]</sup> The seed of this plant possesses a wide range of therapeutic activities. The seed oil obtained from CP has been used in the indigenous system of medicine for the treatment of cognitive deficits, nootropic activity, brain, and other related disorders.<sup>[3-6]</sup> The CP preferentially helps to recall of memory and also regulates serum biochemistry.<sup>[7]</sup> It improves the functions of the nervous system, nourishes the neuronal cell lines, increases nervous resistance, and provides mild tranquilizing effects.<sup>[8]</sup> In

addition to this the plant extract also has been reported to show various pharmacological effects such as enhancement of learning and memory, antioxidant, and anti-inflammatory properties.<sup>[5,9-12]</sup> This review reports the available data on the traditional, ethnomedical, and pharmacological benefits of CP. In addition, this review also discusses the taxonomical aspects, phytochemistry, bioavailability, beneficial effects of secondary metabolites present in the CP, and future prospects of this interesting multi-purpose medicinal plant.

## METHODOLOGY

A comprehensive literature search was carried out on CP using different means of the scientific databases such as Google Scholar, <http://www.ncbi.nlm.nih.gov/pubmed>, Scopus <http://www.sciencedirect.com>, <http://www.libnet.ulg.ac.be/>

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en/eresources/scifinder-scholar, Drug Bank (<https://www.drugbank.ca/>), Chem Bank (<https://www.chemicalbank.com/>), and phytochemical interaction database. A total of 58 articles obtained from all the sources. Out of 58, 36 articles were obtained from different scientific databases and 22 were from other sources. Among all the articles, 12 were selected for this review, and the process of final selection of articles for this review has shown in Figure 1.

## RESULTS

Out of the 12 studies identified, 2 studies ( $n = 12$ ) were focused on botanical description, propagative methods, and current scenario on usage of CP, 2 studies ( $n = 12$ ) were exclusively focused on ethnomedical and traditional usage, and the rest 8 studies ( $n = 12$ ) were focused on pharmacological profiles of CP.

## DISCUSSION

Majorly two broad categories have been identified in this review, which includes traditional and ethnopharmacological benefits of CP, respectively. The obtained information has been briefly summarized in this paper with the following subheads.

### Botanical description and ecogeographical features of CP

It is an unarmed large woody climber; base: Cuneate, obtuse or rounded, apex acute, acuminate or obtuse, panicles large, terminal, and pubescent; leaves: Simple, alternate, very variable, elliptic, ovate, broadly, obovate or sub-orbicular, glabrous, sometimes pubescent beneath along the venation, and up to 6 cm × 11 cm; male flowers: Minute, pale green, calyx lobes suborbicular, toothed, petals oblong or obovate-oblong, and entire; disk copular: Female flowers having sepals, petals and disk similar to those of male flowers; capsule: Subglobose, bright yellow, trivalved, and 3–6 seeded; and seeds: Ellipsoid, yellowish brown, and enclosed in a red fleshy aril.

### Botanical classification of CP

Kingdom: Plantae  
 Subkingdom: Tracheobionta  
 Superdivision: Spermatophyta  
 Division: Magnoliophyta  
 Class: Magnoliopsida  
 Subclass: Rosidae  
 Order: Celastrales

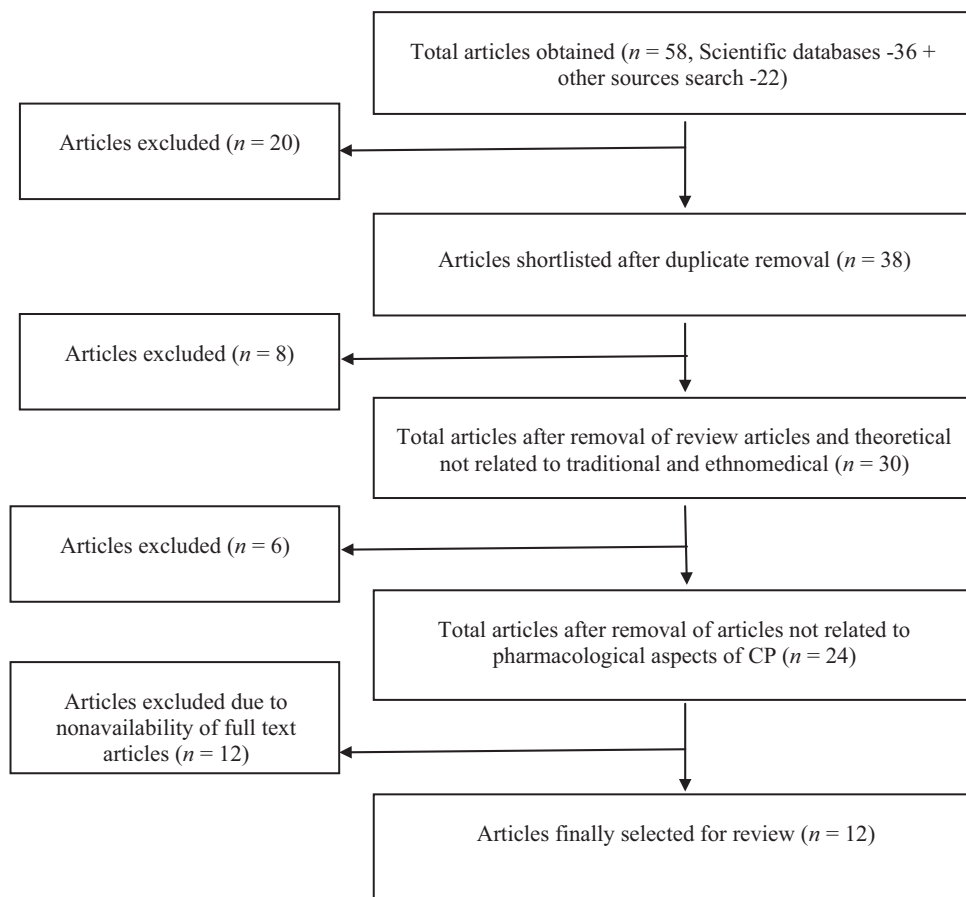


Figure 1: Schematic representation of the articles selected for review

Family: Celastraceae  
 Genus: *Celastrus* L.  
 Species: *Celastrus paniculatus* Wild.

It is a native of the Indian continent but is known to grow widely in Australia, China, Taiwan, Cambodia, Nepal, Sri Lanka, Thailand, Vietnam, as well as many of the Pacific islands. It has also been transplanted and grown in every continent except Antarctica. More recently, it is being cultivated in Africa.<sup>[13]</sup> This hardy bush has been growing above an elevation of 5900 feet, along with the Himalayan mountainside, Western Ghats, Eastern Ghats, and in other high altitude environments. It is a rare plant of Odisha, particularly found in all of its forest blocks but is abundantly found in simlipal biosphere reserve forest, Karlapat sanctuary, and Niyamgiri hills.<sup>[14,15]</sup>

### Traditional and ethnomedical properties of CP

The discovery and study of natural bioactive compounds present in CP with pharmacological properties have raised considerable interest over recent decades for the isolation, identification, and development of pharmacotherapeutic candidates for use in the treatment of several neurological disorders. The traditional and ethnomedical properties and its therapeutic conventions have been shown in Tables 1 and 2.<sup>[16-43]</sup>

### Phytoconstitutive profile of CP

The isolation, characterization of bioactive compounds present in the CP has been carried out by several researchers previously, but biological evaluation of these compounds has not been revealed yet completely which could account for its pharmacological

importance of CP. Till today, approximately a total of 60 bioactive compounds have been detected in CP through different scientific techniques such as high-performance liquid chromatography (LC), LC-mass spectrometry (LC-MS), gas chromatography-MS, and tandem MS (MS/MS). The available structures of identified compounds have been listed out, and their collision-induced dissociations have been shown in Table 3.<sup>[44,45]</sup>

### Neuroprotective properties

Gaitonde *et al.* reported that the seed oil of CP has administered at a dose of 100 mg/kg as an emulsion exhibited the tranquilizing, anti-sedative, and antispasmodic effects against amphetamine-induced excitement and toxicity in an animal model of mice.<sup>[46-48]</sup> The seed oil extract of CP has reported for analgesic activity when administered to mice at a dose of 2 mg/kg b.w.<sup>[49]</sup> It is also reported that the learning and memory processes have been enhanced in mice treated with seed oil of CP at a dose of 1 ml of 5% emulsion for 3 days and the activity was significantly enhanced when administered for 7 days.<sup>[50,51]</sup> As per the reports of the Nalini *et al.*, the biogenic amine levels were significantly modulated by the seed oil of CP when compared to the drug-treated groups.<sup>[52]</sup> Again Gattu *et al.* have proved the same activity against scopolamine-induced toxicity which aid to provide memory deficits in mice using Morris Water Maze Task.<sup>[16]</sup> On the other hand, among all the crude extracts such as aqueous, methanol, ethanol, chloroform, petroleum ether of CP, and the aqueous and methanolic extracts at a dose of 200 mg/kg b.w. and 300 mg/kg b.w. have found to be effective in preventing cognitive deficits as well as antioxidant properties in mice model.<sup>[5]</sup> Godkar *et al.* have reported the neuroprotective properties of CP in *in vitro* models using neuronal cell cultures

**Table 1:** List of usage of CP by various traditional systems and their therapeutic conventions

Systems	Therapeutic convention	Reference
Ayurveda	Used as/for stimulant nerve tonic, rejuvenant, sedative, tranquilizer, and diuretic. In the treatment of rheumatism, gout, leprosy, leukoderma, paralysis, and asthma	[8, 16]
Vagbhatta Samhitha	Used as remedy for mental illness	[43]
Charaka Samhitha	Used for headache, depression, swooning, and as a laxative for digestive system	[43]
Sushruta Samhitha	Used for neurological disorders, urinary infections, skin affections, intestinal parasites, wound healing, and purgative	[43]
Chakradatta Samhitha	Used for induction of menstruation and as de-addiction aid	[43]
Ayurveda classics	Used as a Brain tonic, (Bhavaprakasha, Raaja Nighanta, and Shivadatta Nighanta)	[17]
Unani	Used for bells palsy, neurasthenia, hemiplegia, lumbago, and gout	[18]
ITSM	Used as appetizer, laxative, emetic, aphrodisiac, and used for cough and leukoderma	[19]
IMS	Used as brain stimulant and antioxidant	[20]
Siddha medicine system	Used for fatigue, ITMS plus IMS	[43]
Thai medicinal practioners	Used for Intermittent fever, dysentery, diarrhea, and fever	[21]
Northeast folk medicine	Used for lactagogue, malaria	[22,23]
China traditional medicine	Used as/for natural insecticides, fever, chill, joint pain, edema, rheumatoid arthritis, and bacterial infection	[24,25]

ITSM: Indian traditional system of medicine, IMS: Indigenous medicinal system, *C. paniculatus*: *Celastrus paniculatus*

**Table 2:** List of ethnomedical usage and their therapeutic conventions of CP

Systems	Therapeutic convention	Reference
Himalayan folklore medicines	Used for hemorrhoids, piles, gout, rheumatism, cold, dysentery, diarrhea, leprosy, snake-bite, and wounds	[26]
Codified literature of Himachal Pradesh	Used as/for cardiogenic, appetizer, acidity/gas, intestinal worms, infections of skin	[27]
Haridwar District, Uttaranchal state	Used for headache and pneumonia	[28]
Gond tribe of Uttar Pradesh	Used for cancerous tumors	[29]
Chhindwara and betul districts, pupil live in mid-Madhya Pradesh	Used to treat Rheumatism	[30]
Tribes of Rewa district	Used to cure leukorrhea	[31]
People of Mayurbhanj district of Odisha	Used for joint diseases, gout, and rheumatism	[18]
Tribal people of Gujarat	Used for gout, hair care	[32]
Ambaji forest of Banaskantha district of North Gujarat	Used to cure mental disorders, swellings and fractures, rheumatism, and paralysis	[33]
Herbal vendors of south India	Used to treat wounds	[34]
Valaiyans of Karandamalai of South Eastern Ghats of Tamil Nadu	Used for the purpose of abortion	[35]
Paliyan tribes of Sirumalai hills of Southern India	Used to treat nervous disorders	[36]
Central Western Ghats in Karnataka	Used to cure excessive pain during menstruation and to induce fertility	[37]
Bhilla tribes of Dhule, Jalagaon, and Nandurbar districts of Maharashtra	Used to treat rheumatism and painful joints	[38,39]
Pawaras, Bhilla and Konkani tribes of Nandurbar district of Maharashtra	Used to cure paralysis	[33]
Medicine men of Buldhana districts	Used for paralysis and joints till cure	[40]
Tribal communities of Purandhar, namely Dhangars and Gawalies	Used for joint pain	[41]

against glutamate toxicity.<sup>[53]</sup> In addition to the previous reports, Rajkumar *et al.*, and Jadhav, and Patwardhan, have observed the anxiolytic properties and behavioral modulatory effects in mice using neurobehavioral tests.<sup>[11,54]</sup>

### Cardiovascular

Somanadhan *et al.* in his finding regarding cardiovascular effects, it was observed the gradual fall of cardiac output, marked increased in the pulse pressure and inhibition of angiotensin-converting enzyme in the animal model of cat administered with seed oil as emulsion and aqueous extract of CP at a dose of 50–100 mg/kg.<sup>[55]</sup>

### Antifertility

Wangoo and Bidwai have stated that the seed oil of CP has shown antispermatogenic/antifertility effect in mice on treatment with a dose of 0.2 ml/animal/48 h to adult albino rats for 30 days. It also reduced the focal necrosis and degenerative changes in the liver during the treatment.<sup>[56,57]</sup>

### Analgesic and anti-inflammatory

Ahmad *et al.* quoted that CP has shown both analgesic and anti-inflammatory activities when compared with aspirin.<sup>[9]</sup> The seed oil of CP has exhibited the 78.78% of inhibition of inflammation in carrageenan-induced rat paw edema.<sup>[58]</sup>

### Hypolipidemic

Mathur *et al.* have reported that the methanolic crude extract of CP has significantly exhibited the hypolipidemic effect in mice model. The cholesterol levels were completely reduced in mice on pre-treatment with ethanolic extract of CP when compared to the hypolipidemic group.<sup>[59]</sup>

### Antioxidant activity

Russo *et al.* and Godkar *et al.* have stated that different extracts of CP such as methanolic extract, aqueous, seed oil, and acid fractions exhibited efficient antioxidant and DNA protection activities in mice model.<sup>[2]</sup> In addition to that, the extracts also have shown neuroprotective properties against

**Table 3:** List of the compounds and their available structures of *C. paniculatus*

Phytoconstituents	PubChem CID
Malkanguniol	6325578
Malkangunin	90473155
Celapanine	442518
Celapanigine	C100013182 (KNAPS Met.Inf)
Celapagin	45270481
Celastrine	5315764
Paniculatine	11087072
Celastrol	122724
Pristimerin	159516
Zeylasterone	13945472
Zeylasteral	11591321
Acetic acid	176
Benzoic acid	243
Oleic	445639
Linoleic	5280450
Linolenic	5280934
Palmitic	985
Stearic	5281
Crude lignoceric acid	11197
Tetracasanol	10472
Tetra Sterol	15227647
Beta amyirin	73154
Beta-sitosterol	222284
Phytol	5280435
Erucic acid	5281116
Trans-beta-copaene	87529
Linalool	6549
Murrolene	12306047
Cubenol	11770062
Valeric acid, 3-pentadecylester	559042
Phytone	1810793
Palmitaldehyde diallyl	984

Source: PubChem and Drug Bank, 2018. *C. paniculatus*: *Celastrus paniculatus*

hydrogen peroxide and glutamate-induced neurotoxicity in neuronal cell cultures.<sup>[60,61]</sup>

### Antiarthritic activity

It is revealed that the petroleum and alcoholic extracts of CP seed possess antiarthritic effects. During the antiarthritic condition, animals treated with CP extracts have increased body weights and reduced the swelling of the paw when compared to the arthritic group of animals.<sup>[62]</sup>

### Wound alleviate property

Harish *et al.* have isolated a bioactive compound from the leaves of CP, and quoted the wound healing property in animal models of albino mice. The lupeol has shown the greater activity of wound healing when compared to the standard (nitrofurazone).<sup>[10]</sup>

### Antimalarial

It is reported that out of all the crude extracts (methanol, ethanol, aqueous, ethyl acetate, n-hexane, n-butanol, chloroform, and petroleum) of root, bark, stem, and seeds of CP, the chloroform fraction of stem, the methanolic fraction of seed and pristimerin, and a bioactive compound isolated from chloroform fraction of seed have exhibited the antimalarial activity against various multidrug resistance isolates of *Plasmodium falciparum*. The pristimerin has shown potent antimalarial activity than the conventional antimalarial drugs.<sup>[63]</sup>

### Antibacterial

Earlier studies have reported that different extracts of leaves, root, and seeds of CP have exhibited the antibacterial activity. Patel and Trivedi reported that the seed oil obtained from CP has shown antibacterial activity against *Micrococcus pyogenes* var. *aureus*, *M. pyogenes* var. *albus*, *M. pyogenes* var. *citreus*, *Bacillus subtilis*, *Corynebacterium diphtheriae*, *Salmonella typhosa*, *Salmonella paratyphi* A and B, *Escherichia coli*, *Proteus vulgaris*, and *Pseudomonas pyocyanea*. Russo *et al.* and Pandya *et al.* have also mentioned the same property of aqueous extract of CP seed against *Bacillus cereus*, *Klebsiella pneumonia*, *Proteus morgani*, *P. vulgaris*, *Salmonella marcescens*, *S. typhosa*, *Salmonella paratyphi* A, *E. coli*, *Pseudomonas aeruginosa*, *Staphylococcus lutea*, and *Staphylococcus aureus*.<sup>[2,64,65]</sup>

### Fungicidal activity

Vonshak *et al.* have mentioned that different extracts of CP such as aqueous extract of leaves, root, and seed oil extracts have exhibited the antifungal activity against 6 species of fungi (*Trichophyton mentagrophytes*, *Trichophyton rubrum*, *Trichophyton soudanense*, *Candida albicans*, *Torulopsis glabrata*, and *Candida krusei*), three dermatophytes (*Trichophyton* spp.), and 3 yeasts (*Candida* spp.).<sup>[66]</sup>

### Toxicity evaluation

Nalini *et al.* have reported the non-toxic and non-mortality dose of CP oil in mice, i.e., 5g/Kg b.w., whereas lethal cutoff doses of different extracts of CP such as petroleum ether extracts and alcohol extracts have reported as 500 mg/kg and 300 mg/kg, respectively.<sup>[52,62]</sup>

## Current scenario

With reference to the Indian context, which is a native for a maximum number of medicinal plants, more than 70% of the population use herbal drugs for their health. Among those CP is being used as a major component in many numbers of pharmaceutical formulations because of its versatile properties. Although CP possess great pharmaceutical values, the indiscriminate overexploitation of this plant to meet growing demand made this plant close to threatened status, and listed as vulnerable and endangered medicinal plant.<sup>[67]</sup> Hence, a remedial measure to be taken to maintain the species sustainability to derive in-depth therapeutic modalities regarding the mentioned properties above.

## CONCLUSION

The information mentioned in the above about this versatile medicinal plants indicates that CP is a truly elixir of life. Therefore, keeping in view of the therapeutic importance of this plant, extensive clinical trials are needed to develop effective therapeutic modalities for the management of neuropharmacological and other related disorders.

## GRAPHICAL ABSTRACT



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