Review Article

Pharmacological Activities of *Celastrus paniculatus Willd.* : A Review

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ABSTRACT

Current review includes medicinal importance and various pharmacological activities of *Celastrus paniculatus Willd*. *Celastrus paniculatus Willd.* belongs to *Celastraceae* family. It is a plant of medicinal importance and is being used in Ayurveda from a very long time to treat different disorders mainly brain related disoders. It is also known as 'Tree of life'. It is commonly known as Malkangani and Jyothishmati in hindi and sanskrit respectively. Different studies have proved that it has various pharmacological activities which includes neuroprotective activity, rejuvenative activity, cardiovascular activity, analgesic activity, anti-inflammatory activity, anti-infertility activity, antioxidant activity, free radical scavenging activity anti-arthritic activity etc. It has been proved in various studies that *Celastrus paniculatus willd.* is a potent drug for improving memory and intellect. This manuscript reviews current information on various pharmacological and medicinal activities of *Celastrus paniculatus*.

Keywords: *Celastrus paniculatus* Willd., Malkangani, Pharmacological activities, Celastraceae, Jyothishmati, antioxidant activity.

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INTRODUCTION

Celastrus paniculatus Willd. belonging to family Celastraceae is a woody liana and is also known as 'Elixir of life'. It is large, woody climbing shrub with 10 m height, elongating branches which are reddish brown in colour.[1] It is known as Malkangani in Hindi and Jyotishmati in Sanskrit.[2, 3] It is widely distributed in the Maldives, Australia, China, Cambodia, Malaysia, Taiwan, Nepal, Thailand and in the Pacific Islands. In India it is found mainly in Maharashtra, Andaman and Nicobar on an altitude of 1800m.[4] It has a major role in Ayurveda, Folk medicine, Sowa-Rigpa, Unani, Siddha.[5] This plant is used extensively. The oil obtained from *Celastrus paniculatus* is bitter, thermogenic and promotes intellect. This seed oil plays an important role in abdominal disorders, sore and beri-beri.[6]

Taxonomical classification[8]

Kingdom - Plantae
Sub –kingdom - Tracheobionta
Superdivision - Spermatophyta
Division - Magnoliophyta
Class - Magnoliopsida
Order - Celastrales
Family - Celastraceae
Genus - Celastrus
Species - Paniculatus

Table 1: Medicinal properties of various parts of *Celastrus paniculatus*[7]

Plant part	Medicinal properties
Bark	Abortifacient, Wound healing, Sedative, Bronchodilator
Root	Antidote for Snake bite poisoning
Leaves	Emmenagogue
Leaf Sap	Antidote for Snake bite poisoning
Seeds	Memory enhancer, aphrodisiac, febrifuge, diuretic, anti-inflammatory, antihepatotoxic, emollient, laxative.

Figure 1: *Celastrus paniculatus* (Malkangani) Plant with fresh seeds.

Figure 2: Dried seeds of *Celastrus paniculatus*

Vernacular names

Table 2: Vernacular names of *Celastrus paniculatus*

Languages	Names
Hindi	Malkangani, Malkakni [9]
English	Black oil tree, Climbing staff tree[10]
Sanskrit	Malkangani, Velo[11]
Malyalam	Polulavam[12]
Kannada	Kariganne[13]
Tamil	Valuluvai[14]
Telugu	Malkangani[15]

Chemical constituents

Table 3: Chemical constituents of various parts of *Celastrus paniculatus*

Parts of the plant	Chemical constituents
Seeds/Seed Oil	**Sesquiterpene alkaloids:** Palmitic acid, Phytol, Erucic acid[16] **Monounsaturated and polyunsaturated fats** **Sesquiterpene ester:** 1α, 8β-triacetoxy-9β-benzoyloxydihydro beta-agarofuran 1α, 6β, 8α-triacetoxy- 9α-benzoyloxydihydro-beta agarofuran angulatueoid C, tetra acetoxy-9α-benzoyloxy dihydro beta-agarofuran.[17] **Triterpenoids:**[18] Pristimerin **Fatty acids:**[19] Oleic acid (54.42%), palmitic acid (20%), linoleic acid (15.51%) and stearic acid (4.18%). Malkanguinol, Malkangunin. **Volatile oil:**[20] Lignoceric acid. **Polyalcohol esters:**[21,22] Malkagunuin, Polyalcohol A, B, C and D **Sterols:** Vitamin C, minerals, carbohydrates and proteins are also found in the seeds.[23,24]
Stem	**Alkaloid:** [25] Wifornine F, Paniculatine A, Paniculatine B.
Rootbark	Petroleum ether extract of the root bark of *Celastrus paniculatus* shows - **Alkaloids:**[26] n- triacontanol and pristimerin, benzoic acid, uncharacterized quinine and golden-yellow oil. **Quinone:**[26] Zeylaseral, zeylasterone, celastrol. **Triterpenoids:**[26] methide, phenolic triterpenoids.
Leaves	**Alkaloids:** alkaloid, a glycoside, a coloring matter.[27]

PHARMACOLOGICAL STUDY

Hypolipidaemic activity

In comparison to the induced hypercholesterolemic animal group, oral treatment of methanolic seed extract (50%) of *Celastrus paniculatus* at the optimal dose of 65 mg/kg body weight significantly lowered plasma total cholesterol, triglycerides, and LDL cholesterol with results that were comparable to the conventional hypocholesterolemic medication and practically identical to the control group. In comparison to hypercholesterolemic animals, the atherogenic index and liver weight of treated animals decreased significantly. When compared to the control group, it significantly boosted HDL cholesterol levels. Increased activity of lipoprotein lipase and plasma LCAT boosted hepatic bile acid synthesis and as a result, increased cholesterol breakdown to neutral sterols. Furthermore, HMG-CoA reductase and glucose 6-phosphate dehydrogenase activities were dramatically lowered. When compared to generated hypercholesterolemic mice, histological tests revealed that animals fed seed extract of *C. paniculatus* had reduced cholesterol deposits in the aorta.[28]

Anxiolytic activity

In a staircase test in mice, *Celastrus paniculatus* plant extract reduced the beginning of action in pentobarbitone-induced sleep, increased the overall duration of sleep and

demonstrated anxiolytic effects.[29] Celastrus oil derived from *Celastrus paniculatus* seeds, had strong anxiolytic efficacy and did not generate tolerance when evaluated at two dose levels (1 and 1.5 g/kg). The non-sedative nature of buspirone, as well as the reversal of buspirone-induced behaviour (in open field exploration), suggest to a serotonergic mechanism underpinning anxiolysis.[30]

Neuroprotective activity

Protective effect on H_2O_2 -induced cytotoxicity and free-radical scavenging action, which is dose dependent were shown by *Celastrus paniculatus* methanolic extract. It also showed damage of DNA in non-immortalized fibroblasts of human beings.[31] Water extract of *Celastrus paniculatus*, reduced lipid peroxidation and increased the enzyme catalase activity (which is antioxidant in nature), as a result it protected cultured neuronal cells of forebrain.[32] CP water extract showed neuroprotective action against toxicity caused by glutamate in neuronal cultures and reversibly inhibited N-methyl-D-aspartate-activated whole currents.[33] It was reported that Chronic oral administration of oil of *Celastrus paniculatus* seeds (50, 200, or 400 mg/kg) for 14 days time period has reversed the scopolamine (0.5 mg/kg)-induced learning deficits completely.[34]

Anticonvulsant activity

Petroleum ether extract of seeds of *Celastrus paniculatus Willd*. is used in this study. Seizures in mice are induced by maximum electroshock and pentylenetetrazole. The extracts (petroleum ether and ethanolic) were given intraperitoneally at doses of 200 mg/kg, 400 mg/kg, and 600 mg/kg. Seizure delay, death time and percent mortality were all measured. EECP and PECP provided considerable protection against convulsions caused by MES (maximal electroshock) and PTZ (pentylenetetrazole). PECP in PTZ has a p value less than 0.001 while MES in PECP has a p value <0.01, P<0.001. Statistical significance was found. The presence of alkaloids, tannins, phenolic compounds, fatty acids, steroids, flavonoids is revealed by phytochemical screening of the plant. The findings point to the plant extract of *Celastrus paniculatus Willd*. have marked efficacy in convulsions.[35]

Nootropic activity

Oral administration of aqueous extract of *Celastrus paniculatus* seeds in two different doses to rats (350 and 1050 mg/kg) and to mice (500 and 1500 mg/kg) was conducted. Obtained results were compared with piracetam (100 mg/kg, p.o.) which is used as a standard drug. It is reported that the aqueous extract of *Celastrus paniculatus* seeds has dose-dependent cholinergic activity which improved memory performance in rats and mice. It is estimated that increased acetylcholine level in rat brain may be the mechanism by which *Celastrus paniculatus* enhances cognition.[36]

Cardiovascular activity

The crude CP seed oil administered as emulsion (50-100 mg/kg) produced a gradual fall in cardiac output, bradycardia and marked increase in pulse pressure on isolated heart lung preparation in cat. A similar action with 1 g of emulsified oil was also observed in dogs. The aqueous extract of CP seed showed 50% angiotensin converting enzyme (ACE) inhibition; ethanol extract showed mild activity while the acetone extract was devoid of it.[37]

Antifertility activity

It is reported that the seed oil had antispermatogenic effects in adult albino rats when given at a dose of 0.2 ml/48hrs. (i.p.) for 30 days, as demonstrated by vacuolization of seminiferous tubules, germ cell loss and exfoliation, ending in spermatogenesis arrest. In the last stage of spermatogenesis impairment, the shrunken tubules revealed only sertoli cells and spermatogonia. When administered with 0.2 ml (i.p.) seed oil for 30 days, liver of mice showed localised necrosis, but these lesions were gone 45 days later. These findings suggest that CP oil has antifertility properties and that the degenerative alterations in the liver can be reversed.[38]

Analgesic and Anti-inflammatory activity

Methanolic extract of flowers of *Celastrus paniculatus* was prepared by extraction by using absolute methanol. Hot water tail immersion test in mice and carrageenan induced paw edema in rats are the tests which are employed in this procedure. Prepared extract was tested for oral analgesic and anti-inflammatory activity. This study reported that CP had analgesic and anti-inflammatory both activities. The oil showed anti-inflammatory activity in carrageenan-induced rat paw oedema. 66.60% and 78.78% inhibition of inflammation is shown by seed oil in doses 5ml/kg and 10 ml/kg compared to 75.75% shown by 100 ml/kg dose of ibuprofen.[39]

Also, phytochemical screening and studies were conduted by Ahmad et al. in 1994, which reported that the methanolic extract of *C.paniculatus* seeds produces analgesic and anti-inflammatory effects in mice and rats.[40]

Antiprotozoal activity

It is reported that the antimalarial activity of a fraction of the chloroform extract of the root bark of *Celastrus paniculatus* is the strongest. The active theory was known as pristimerin, a quinonoid triterpene. When pristimerin was tested in vitro against various multidrug resistant isolates of Plasmodium falciparum, it was found to be less effective than the other antimalarial drugs.[41]

Anti-Alzheimer activity

The anti-alzheimer (AD) activity of the crude methanolic extract of *Celastrus paniculatus* plant as well as its organic soluble fraction was investigated. The extracts demonstrated strong DPPH free radical scavenging activity as well as inhibition of authentic peroxynitrite (ONOO-) activity and total reactive oxygen species (ROS) generation. The EtOAc fraction had the highest activity in the DPPH radical scavenging assay, with an IC50 value of 25.921.02

g/ml. Scavenging the authentic ONOO- system revealed that all extracts/fractions were active, with the EtOAc fraction having the highest activity with an IC50 of 15.790.18 g/ml. The EtOAc fraction had major (pp0.001) inhibitory effects on cholinesterases, with IC50 values ranging from 134.7-227.5 g/ml for AChE and 209.6-562.1 g/ml for BChE.[42]

Anti-depressant activity

It is reported that both stressed as well as unstressed mice in FST showed significant decrease in the immobility period when administered *Celastrus paniculatus* seed oil in doses 50, 100 and 200 mg/kg b.w. by p.o. route for 14 succesive days and hence showed significant effect just like an antidepressant.[43]

Wound healing activity

Excision, incision, and dead space wound models on Swiss albino rats were used to test a triterpene compound lupeol isolated from petroleum ether extract of CP leaves for wound healing operation (8 mg/ml of 0.2 percent sodium alginate gel) (175-225 g). Wound healing activity was significantly higher in lupeol-treated groups than in nitrofurazone-treated groups. In comparison to the control group, epithelialization of the incision wound was quicker, with a higher rate of wound contraction. The weight of the granulation tissue of the lupeol-treated animal increased in a dead space wound model, suggesting increased collagenation and the absence of monocytes.[44]

Antioxidant activity

It is reported that Methanol, ethyl acetate, pet ether and water extracts of *Celastrus paniculatus* seed have antioxidant capacity. Total phenol and flavonoid content determination assays, total antioxidant capability, 1,1-diphenyl-2-picrylhydrazil (DPPH) free radical assay, Reducing power assessment, Nitric oxide (NO) scavenging assay, and Cupric ion reducing capacity assay were used to assess antioxidant activity. When compared to ascorbic acid, ethyl acetate extract had the lowest IC_{50} value (585.58g/ml) in the DPPH radical scavenging assay. The IC_{50} values for the Water, Methanol, Ethyl Acetate and Pet Ether extracts in the nitric oxide scavenging assay were 122.99g/ml, 320.54g/ml, 601.81g/ml, and 206.37g/ml, respectively, compared to 6.83g/ml for the reference ascorbic acid extract. The findings show that the extracts have antioxidant potential.[45]

Anti-arthritic activity

It is reported that petroleum ether fraction (PCP or Petroleum ether extract of dried seeds) produced from *Celastrus paniculatus,* when given to rats in doses 200mg/kg and 400 mg/kg, significantly suppressed swelling in a dose-dependent manner, thereby reducing the arthritic score in the FCA-injected paw ($P < .01$). It considerably decreased arthritic progression with respect to paw swelling, arthritic score, immune organ indices and body weight. This result was connected with considerable suppression of overproduction of inflammatory cytokines (TNF-α and IL-6), oxidative stress indicators (MDA and NO) and cellular enzyme (AST, ALT and ALP) levels compared to arthritic mice without therapy.[46]

Gastroprotective and Anti-ulcer activity

Celastrus paniculatus seed oil (CPO) in rats when used against various gastric ulcer models, reported to have gastroprotective and antiulcer properties. The gastroprotective and antiulcer effects of CPO were assessed using pylorus-ligated ulcers caused by ethanol and indomethacin, with rantidine (40 mg/kg per os [PO]) as a control. Gastritis was used to assess gastrointestinal motility. Gastric emptying period and gastrointestinal transit ratio were used to assess gastrointestinal motility. The results of pharmacological studies of CPO (200 mg/kg, 400 mg/kg) showed that it provided effective gastroprotection in ulcer models caused by ethanol and indomethacin. The seed oil showed gastroprotective activity in pylorus-ligated rats, reducing total gastric juice volume and acidity while increasing gastric pH.[47]

CONCLUSION

The study done in this manuscript proves that various parts of *Celastrus paniculatus* have abundant Pharmacological activity including hypolipidaemic activity, anxiolytic activity, neuroprotective activity, anticonvulsant activity, nootropic activity, cardiovascular activity antiprotozoal activity, anti-alzheimer activity, anti-depressant activity, wound healing activity antioxidant activity, anti-arthritic activity, gastroprotective and anti-ulcer activity.

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