



IJAYUSH
International Journal of AYUSH
<http://internationaljournal.org.in/journal/index.php/ijayush/>

*Panacea
Research
Library*

ISSN: 2349 7025

AYURVEDA, YOGA, UNANI, SIDDHA AND HOMEOPATHY

Review Article

Volume 7 Issue 3

PHARMACOLOGICAL PROFILE OF JYOTISHMATI (*CELASTRUS PANICULATUS* WILLD): A REVIEW

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Article history:

Received: 31st July 2018

Received in revised form:
4th August 2018

Accepted: 4th August 2018

Available online:
August 2018

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These authors have no conflict
of interest to declare.

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Abstract

The awareness of the role of medicinal plants in healthcare in developing countries results in exploring the natural herbal medicine. *Jyotishmati* (*Celastrus paniculatus* Willd.) commonly known as 'Malkangni' is a traditional medicinal plant which has been used for thousands of year in Ayurvedic system of medicine as a Medhya (intellect promoting) drug. Mainly oil from seeds is used for stimulating intellect, sharpening memory and in the treatment of brain related disorder of all the age group. It also reported as a potential nervine tonic, rejuvenator and an anti-depressant. It possesses various pharmacological activities like anti-oxidant, anti-arthritic, analgesic, anti-inflammatory, anti-fertility, anti-malarial, anti-bacterial, anti-fungal, hypolipidaemic etc. This paper aims to compile all information regarding its various traditional uses, pharmacognosy, phytochemical constituents and pharmacological activities to enrich our knowledge about this plant. It will surely give new direction for the researchers and pharmaceutical industries to develop a new drug.

INTRODUCTION

Ayurveda is a 5000 year old system of natural healing. It is originated by the Vedic culture of India. The herbs mentioned in Ayurveda have multitude of benefits for mind, body and spirit. *Celastrus paniculatus* is one of the most important medicinal plant of Celatraceae family commonly known as 'Jyotishmati' which is deciduous, woody forest climber growing mostly in the hilly region. The name *Jyotishmati* means enlightenment of pscho motor function (*Jyoti*-Enlightment, *Mati*- Brain functions). The seed oil (*Jyotishmati taila*) is known for *Medhya* (intellect promoting) action. *Jyotishmati* is used as a brain tonic to promote intelligences and to sharpen the memory. [1] Ayurveda, the ancient Indian traditional system of medicine has used this plant for prevention and treatment of various diseases. Various medicinal properties are present into the aerial parts and seeds of this plant. It is also beneficial in neurological disease and pain disorders including muscles cramps, backache, sciatica, osteoarthritis, facial paralysis and paralysis [2]

Synonyms

Jyotishmati - (indicates *Medhya* property); *Katbhi*, *Jyotishka*, *Kanguni*- (seeds resemble that of a variety of grains called *kanguni*); *Paravathpadi*- (plant having white/grey spot which resembles the foot of pigeon); *Pinya*- (they are articles of trade); *Lata*- (it is a climber); *Kakandi*- (fruit is similar to crow's egg.) [3]

Vernacular Names

Eng-staff tree, black oil plant, climbing staff tree, intellect tree; **Hindi**- Malkangni, malkauni, maltangun; **Marathi**- skanguni; **Bangali**- latafatki, vanunchhe; **Kannad**- kariganne; **Gujrati**- Malkangni; **Telgu**-kasara tige; **Tamil**-valuluvai; **Oriya**-korsana; **Urdu**- habbe killkil. [4]

Habitat

Jyotishmati found in all over India especially in Punjab, Kashmir and all hilly area at the altitude of 3000m. It also found in Shrilanka, Maldives and Philippines. [5]

Taxonomical Classification [6]

Botanical name: *Celastrus paniculatus*

Kingdome: Plantae

Subkingdom: Angiosperms

Class: Magnoliopsida

Division: Tracheophyta

Order: Celastrales

Family: Celastraceae

Genus: *Celastus*

Species: *Paniculatus*

Morphology

C. paniculatus Willd. Is a climber or scrambling shrub, with terete branches, the young shoots and branches are pendulous. **Leaves-** Glabrous, broadly ovate or obovate; acuminate or acute. **Flowers-** Unisexual, yellowish, pendulous panicles (flowering throughout the year.)

Fruits- Capsule, globose, 3-valved, 3-celled, 3-6seeded.

Seeds are red arillus, ovoid and brown.^[7]

Classification of Jyotishmati in Vedas

Charak Samhita- Classified under *mulini, shirovirechana, shirovirechnopaga*.^[8] Charaka mentioned *Jyotishmati* among the sixteen *mulani* drugs and also in *shirovirechniya dravya* which means *Charaka* indicates useful part of *Jyotishmati* is roots.^[9]

Shushruta Samhita –Classified under *adhobhaghar, shirovirechana* ^[10] and *arkadigana* in this synonym *alavana* is used for *Jyotishmati*. *Shushruta* also mentioned it in *nadiwrana chikitsa*,^[11] *krumi, kushta, prameha* ^[12] and *unmad*^[13]

Ashtang hridaya -Classified under *arkadi gana*.^[14]

Nighantus- There is the mention of *Jyotishmati* in the following *Vargas* of various *Nighantus*

Bhavprakash nighantu- Haritkyadi varga ^[15]

Rajnighantu- Guduchyadi varga ^[16]

Madanpal nighantu- Abhayadi varga ^[17]

Dhanvantari nighantus- Guduchyadi varga ^[18]

Kaiyadeva nighantus- Aushadhi varga [19]

Shodhal nighantus- Guduchyadi varga [20]

Rasapanchaka of Jyotishmati [21]

Rasa (Taste) – *Katu* (pungent), *Tikta* (bitter)

Guna (Quality)-*Tiksha* (penetrating)

Veerya (Potency) – *Ushna* (hot)

Vipaka – *Katu*.

Prabhav- Medya

***Jyotishmati* – Effect on Tridosha**

With its *Katu* (pungent) and *Tikta* (bitter) taste and *ushna Veerya* it alleviates *kapha*. Its *Shingha guna* and *Ushna Veerya* alleviates *vata*. [22]. It is traditionally used as *Medhya* (intellect promoting), *Deepan* (Appetizer), *Vatanuloman* (maintain normal *gati* of *vata*.), *Vamak*(induces vomiting), *Mrudurechaka* or *Mootral* (Diuretic), *Shirovirechana* (removes *Dosha* by nasal route), *Hridya uttejaka* (stimulate heart), *Aarthava janana* (induces menstruation), *Kushtagna*(useful in skin disorders) ,*Vedanasthapana* (reduces pain), *Jwaragna* (anti-pyretic), *Buddhivardhaka* (promotes intellect), *Smrtivardhak* (sharpens memory), *Kaphagna* (alleviates *Kapha*).[23][24]

Ethno-botanical study of *Jyotishmati*

C. paniculatus is commonly used in treatment of cold, dysentery, diarrhea, gout, piles by folk in Himalalaya. [25] Powered seeds are taken with water for acidity and gas. 2-3 tablespoon of power is given orally in morning and evening for 5-6 days for treatment of intestinal worms.[26] Paste of *C. paniculatus* leaves and roots is apply on forehead for headache in Uttaranchal state.[27] The seed oil is applied on body to keep body warmth in winter as well as to relieve pain and blood circulation in State Odisha.[28] Gujarat tribes used seed oil for hair care which makes hair healthy and silky.[29] In Uttar Pradesh, tribes used powered roots for treatment of cancerous tumors.[30] Paste of roots and barks is apply on children's forehead to cure boils in Central India.[31] In Madhya Pradesh, powered bark is given with cow milk for a month to cure leucorrhoea [32] Paste of long roots of *C. paniculatus* and fruit of *Piper longam* L. given 2-3 times in a day with boiled rice water for treatment of leucorrhoea and spermatorrhoea.[33] The literature of

Himalaya Pradesh stated that fruit juice of *C. paniculatus* is useful in cardio-tonic and seeds as appetizer.^[34] Tribes of north Gujarat forest used mixture powdered of dried leaves, fruits, flowers, seeds gives with milk to cure mental disorder and strengthen the mental power.^[35]

Traditional uses of *Jyotishmati*

Jyotishmati is known as *Magzsudhi* (Brain clearer) and believed to promote intelligence and used in *Masthika daurbalya*. It is also used in *Vatavyadhi* (Disorders of nervous system), *Aruchi* (Anorexia), *Kashtarthava*, *Kushta* (skin diseases), *Agnimandya* (Loss of appetite), *Gulma* (Abdominal tumor), *Shoth* (inflammation), *Kasa* (Cough), *Shwas* (Asthma), *Mutrakrucha* (Difficulty in urination), and *Klaibya* (Impotency). And its oil used in external application on *Pakshaghat* (Paralysis), *Ardit* (Facial palsy), *Grudrasi* (Sciatica), *Katishul* (Low backache).^[36] Oil with benzoin, cloves, nutmeg and mace added, it is sovereign remedy in Beriberi and powerful stimulant. Decoction of seeds (1 to 10) with or without the addition of aromatics is given in rheumatism, gout, paralysis and leprosy. Oil is used for relieving rheumatic pains of a malarial character and in paralysis. It is also used in the form of pomatum made by combination of one part of the oil in 8 parts of butter for application to head.^[37]

Prayoganga-

Seeds, Taila, Leaves, Root, Stem, Fruits.^[38]

Roots- The roots of *C. paniculatus* are used as poultice to cure headache. The roots are used to cure excessive pain during menstruation and to induce fertility.^[39] The root is prescribed for dysentery, diarrhea and fever.^[40] Decoction of root is given internally as a brain tonic for depression swooning, as laxative for cleaning digestive system.^[41] The powdered root or roots bark is taken with cow milk once a day for a month to cure leucorrhoea.^[42]

Stem – The stem is used for treating diarrhea, dysentery.^[43]

Leaves- The leaves are used as poultice to cure headache. Leaf sap is good antidote for opium poisoning.^[44] Dried leaves are recommended for inducing menstruation. The leaves are prescribed internally as purgative.^[45] The mixed powder of leaves, fruits, flowers and seeds is taken regularly to cure mental disorders and increased mental power. Boiled leaves are applied externally on swelling and fractures.^[46]

Fruit and seeds- Fruit juice is used as cardio tonic. Paste of the fruits mixed with warm mustard oil when applied externally is good for scalp. 2-3 teaspoons powder of shaded dried fruits is taken to destroy intestinal worms.^[47] Oil (3 drops) mixed with egg yolk is given to patient orally with water for acidity/gas.^[48] the seed oil is extracted and applied externally to keep body warmth in winter season. It is also applied to relieve pain and proper circulation of blood in body.^[49]

Matra- Seeds- 5-15, Oil- 5-15 drops, Seed powder -1-2gm, Used for *vamana*- 2-4gm.^[50]

Formulation- *Jyotishmati taila*, *Smritisagara rasa*, *Jyotishmati choorna*, *Chandanadi taila*, *Karanjadi yoga*.^[51]

Combination with other herbs- Oil is mostly combined with Apricot oil, *Bringhraj* oil for topical application. It is also used with Cardamom, Almonds, *Jatamansi*, and *Sankhpushpi* etc. for memory enhancer.^[52]

Adverse effects

If is given in higher doses (more than 2gm), it may cause *Vamana* (induce vomiting), *Virechana* (induce purgation).^[53]

Treatment - *Godugdha/Gogritha* given internally.^[54]

Adulterant- *Jyotishmati* is confused with the seeds of *Cardiospermum helcacabum* Linn. (Sapindaceae) in west Bengal. The market samples are sometime found adulterated with the fruits of *Duranta* species (verteneceae).^[55]

Cultivation

Celastrus paniculatus can be propagated by seeds. It can be grown in any type of soil but it will require well drained soil. Sowing timing should be after 1st rain. Two seeds should be dropped at the distance of two feet on prepared furrow. Irrigation will be given after sowing and then every 15days of interval.^[56]

Endangered species

Recent studies state that the species *C. paniculatus* is endangered in Western Ghats of south India, Uttar Pradesh and Uttarakand. [57] It is listed as 'vulnerable and endangered medicinal plant' [58]

Jyotishmati as a Medhya rasayana:

Jyotishmati has *Ushna Veerya* and *Tikta rasa*. It promotes *Sadhak Pitta* and enhances *Grahana* and *Smarana* (i.e. grasping power and memory.) [59]

It acts at different level as a *Medhya* drug. At level of *rasa* it stimulates and improves the function of *Jatharagni as well as Majjadhatwagni*. It improves circulation of *rasa* by opening and cleaning the micro channel and thus provides proper nourishment. Thus it performs *Medhya* function. [60]

Description

Macroscopic

Leaves-Fresh leaves are green in Colour, odorless with a slightly acrid taste. The leaves are simple, apex is acute, acuminate or obtuse and base is cuncate, obtuse or rounded. Margin is finely crenate, venation is reticulate, shape is very variable, elliptic, ovate, broadly. The leaves are glabrous; sometime pubescent, average leaf size is 11 cm length and 6 cm breadth. [61] **Seeds**- Dried ripe seeds more or less covered by orange-red crusty aril, seed without aril also found, measuring 5-6 mm in length and 2.5-3.35 mm in breadth, a few roughly three or two sided being convex on the sides. One edge of several seeds shows a faint ridge. Surface usually smooth and hard, Colour - light to dark brown, Odour-unpleasant, taste- bitter. [62]

Microscopic-

Root-Transverse section of root shows circular in outline and consists of multicellular uniseriate trichomes. Outermost is a thin zone of cork which is dark coloured. Secondary cortex is noticeable with polygonal cells in 12-16 layers which contain starch and oil globules. Pith is nearly obliterated in the secondary structure. [63] **Leaves**- Micro-morphological features revealed that the cells of the epidermis were cuticularized. The upper epidermal cells are comparatively larger than lower one, while the lower epidermises have a thick cuticle compare to upper epidermis. The polygonal epidermal

cells observed with anticlinal walls. The leaf shown the presence of anomocytic type of stomata, ranging from 18 to 20 mm in length and 14 to 15 mm in width, they were in abundance on the lower epidermis while upper epidermis had comparatively less and mostly observed along the midrib region of the lamina. [64]**Seed** - Shows single layered epidermis covered externally with thick cuticle which contains stannin and 4-6 layers of thin-walled, collapsed, parenchymatous cells and layer of radially elongated stone cells. The parenchyma of upper one or two layers is longer than of the below with triangular intercellular spaces, inner most layer of parenchyma contain crystals of calcium oxalate. Beneath stone cells layer are quadrangular to octagonal in shape, tangentially elongated cells filled with brownish contents. Endosperm prepared by thin-walled, polygonal, parenchymatous cells shows embryo spatulate contains oil globules and aleurone grains.[65]**Powder** - Oily, dark brown; under microscope observed groups of endospermic parenchyma, stone cells, oil globules and aleurone grains and shows fluorescence under U.V. light as following :-Powder as such brown Powder + 1 N NaOH – Grenish. In Methanol Powder + Nitrocellulose -Light green. [66]

API standard [67]

IDENTITY, PURITY AND STRENGTH

Foreign matter	Not more than 2 per cent, Appendix 2.2.2.
Total Ash value	Not more than 6 per cent, Appendix 2.2.3.
Acid-insoluble ash	Not more than 1.5 per cent, Appendix 2.2.4.
Alcohol-soluble extractive	Not less than 20 per cent, Appendix 2.2.6.
Water-soluble extractive	Not less than 9 per cent, Appendix 2.2.7.
Oil contents	Not less than 45 per cent, Appendix 2.2.8

T.L.C.-T.L.C. of alcoholic extract of *Jyotishmati* on Silica gel 'G' plate using Toluene: Ethyl acetate (90: 10) shows two spots at Rf. 0.82 & 0.94 in visible light. Under U.V. (366nm) four fluorescent zones noticeable at Rf. 0.54, 0.82, 0.89 & 0.94. On interaction to Iodine vapor eight spots found at Rf. 0.04, 0.15, 0.20, 0.54, 0.63, 0 & 0.89. On treating with Vanillin-Sulphuric acid reagent and heating the plate at 105°C for ten minutes four spots appear at Rf. 0.54 (blue), 0.82, 0.89 (greenish blue).^[68]

Phytochemistry (chemical composition) ^[69]

Leaves- Alkaloids, Carbohydrates, Sterol and Triterpenoid phenolic compound, Flavonoid, Tannins, Saponins and fixed oil.

Seeds-Fatty acid composition of seed oil- Saturated fatty acids namely Butyric acids, Caprylic acid, Lauric acid, Myristic acid, Palmitic acids, Stearic acid, Arachitic acid, Mono saturated fatty acids, viz. linoleic acid, Oleic acids, Poly saturated acids, Arachitonic acids.

Seeds also contain around 30% oil content in which following Alkaloids are present. Celapagin, Celapaningin, Celapanin, Celastrine, Paniculatine.

Terpenoids: Dihydro garofuran, Quinonemethide and Phenolic triterpenoids.

Ester compounds: Malkanguniol, Malkangunin, Celapanine.

Steroids: beta-Sitosterol, Celastral, Pristimerin, Zeylesterone.

Preparation of *Jyotishmati* oil ^[70]

Two types of oils are obtained from *Jyotishmati* seeds.

1. Brown or yellow oil (*Malkanguni* oil)- The seeds extracted by compression or on extraction with petroleum ether yield a brown or yellow oil (52%) recognized as *Celastrus* oil. The oil deposits an amount of fat after it has been kept a short time. Its Odour is strong and pungent. When treated with Sulphuric acid it turns into dark bister Colour. It is much used as an external application along with a poultice of the crushed seeds.

2. Black oil (*Oleam Nigrum*) - The *Jyotishmati* seeds submitted to destructive distillation yields the oil known as '*Oleam Nigrum*'. This oil brought forward by late Dr. Herklots as an independent remedy in beriberi.

Difference between brown oil and black oil is the compound and empyreumatic oil gained by the destructive distillation of the seeds of *Celastrus paniculata* which is commonly known as 'Oleum oil' or 'black oil' is quite different from the oil of the same seeds extracted by compression. The former oil is black and thick with a strong and peculiar aromatic smell and the latter, yellow and of the consistence of oil.

Constituents of oil- Protein, Carbohydrates, Fats, Vitamin C, Sodium, Potassium, Ash, Calcium, Iron.^[71]

Uses- It is used to stimulate intellect, sharpen memory and powerful brain tonic. It is used for mentally retarded children to improve IQ.^[72]

Dosage- 10-15 drops of oil twice a day. Higher dose can be used for a more immediate effect.

Toxicity- Highest dose of 5g/kg did not show any toxic effects. It didn't have any lethal or neurotoxic effects. Oil is harmless even if used more than the normal dose administered.^[73]

Shelf life- 2 years in cool and dark places.^[74]

Pharmacological activities:

Neuromodulating effect: The alkali extract of *C. paniculatus* prevents aluminum-induced neurotoxicity in cerebral cortex, hippocampus and cerebellum of the rat brain. It significantly decreased the level of GSH and activities of SOD, CAT, GPx, GR, sodium/potassium ATPase and Mg²⁺ ATPase and increased the level of LPO and the activities of ALP, ACP, ALT and AST in all the brain regions when compared with control rats.^[75]

Anti-nociceptive: *Jyotishmati* seed extract reported to possess significant activity in Swiss albino mice by tail immersion, hot plate and acetic acid induced writhing test models.^[76]

Nootropic activity: *Celastrus paniculatus* whole plant methanol extract was reported for its significant Nootropic activity. It improved the learning and memory of rats, as treating by the decline in transfer latency using high plus maze and also reduced in escape latency during and retrieval Morris water maze.^[77]

Tranquilizing effect: Seed oil produced a tranquillizing effect on rats, mice, monkeys and cats in a dose of 200 mg/kg. It potentiated the effect of hexobarbitone and produced hypothermia in mice. It also reduced spontaneous motor activity, amphetamine-induced hyperactivity and oxygen consumption in mice. [78]

Cognitive enhancing properties: The effect of *Celastrus paniculatus* seed oil was studied using Morris water maze apparatus on the 6th d performance of young adult rats. Internal use of seed oil (50, 100, 200, or 400 mg/kg) for 14 days reversed the scopolamine (0.5 mg/kg)-induced task performance deficit but acute treatment of *C. paniculatus* (200 mg/kg) did not significantly reverse the scopolamine-induced impairment in maze performance. Thus, the seed oil of *C. paniculatus*, when administered regularly, selectively reversed the impairment in spatial memory produced by acute central muscarinic receptor blockade, supporting the possibility that one or more constituents of the oil may offer cognitive enhancing properties. [79]

Learning and memory

Studies showed on mental functions of rats using the aqueous extract of seeds show that the extract improved learning and memorizing capacity. It selectively reverses the impairment in spatial memory produced by acute central muscarinic receptor blockade, but is not related to an anticholinesterase-like action. The oil obtained from the seeds was considered for its effect on learning and a significant improvement was noticed in the retention ability of the *Celastrus*-treated rats compared with the saline administered controls. [80]. Another study shows that *C. paniculatus* affects ability of learning and significantly reduced the AChE activity assayed from hypothalamus, frontal cortex and hippocampus of the rat brain treated with 400mg/kg body weight with CP oil i.e. Jyotishmati oil. [81] Again observation found that the ethanol extract of *Celastrus paniculatus* was given orally at two grams per kilogram body weight of male Wister albino rat's shows significant effect on learning, memory process. [82].

Sedation and Anti-convulsion activity

Study demonstrated that the anti-convulsion potential of petroleum ether and ethanolic extract seeds of *C. paniculatus* Willd. On maximum electroshock and pentylenetetrazole induced seizures in mice. The both extract petroleum ether and ethanolic 200mg/kg, 400mg/kg, 600 mg/kg were given intraperitoneally. The latency of seizures, death time

and percentage mortality were observed. Both extract gave significant protection against maximal electroshock (MES) and pentylenetetrazole (PTZ) induced convulsion. The p value of petroleum ether extract in PTZ $p < 0.001$ and in MES is $p < 0.01$, $p < 0.001$. was statically significant. The result indicates a possible efficacy potential of the plant extract of *C. paniculatus* Willd.in convulsion. [83]

Studies indicate a sedative property of the oil in cats, monkeys, mice and rats, and an anticonvulsant effect in rats [84].

Antioxidant

Methanolic extract of *C. paniculatus* indicates a dose dependent scavenging capacity and a protective effect on DNA cleavage, confirmed by a significant protective effect on H₂O₂ induced cytotoxicity and DNA damage in human non-immortalized fibroblasts. [85]

Analgesic and Anti-inflammatory

A methanol extract of the flowers of *C. paniculatus* exhibits analgesic and anti-inflammatory activities in the hot water tail immersion test in mice and carrageenan induced pedal edema in rats [86].

Hypolipidaemic

50% ethanolic seed extract was demonstrated to reduce serum cholesterol and LDL-cholesterol levels by 60.10% and 71.70%, respectively. Improved faecal excretion of cholesterol suggests modulation of adsorption is affected. [87].

Anti-arthritic activity

The body weight loss and swelling of the paw in rats during the secondary lesions found during the arthritic condition was corrected on treatment with petroleum ether and alcoholic extracts of the seeds, the study being a supporting proof for the anti-arthritic activity [88]

Anti-fertility

The seed oil was given to adult albino rats for 30 days at dose of 0.2 ml/animal/48 h showed anti-spermatogenic effects caused due to vacuolization of seminiferous tubules, germ cell depletion and exfoliation resulting into an arrest in spermatogenesis [89]

Wound healing activity

A triterpene compound obtained from petroleum ether extract of leaves exhibited a remarkable wound healing activity with a high rate of wound contraction [90]

Anti-malarial activity

Chloroform extract of the root bark containing a quinonoid triterpene, pristimerin was witnessed to have the highest antimalarial activity [91]

Anti-bacterial activity

The seed oil as well as the aqueous extract has an effective antibacterial activity against numerous microbes viz. *B. cereus*, *Corynebacterium diphtheriae*, *Salmonella typhosa*, *S. paratyphi*, *S. dysenterica*, *S. marcescens* *Escherichia coli*, *P. morganii* *Pseudomonas pyocyana*, *S. lutea* and *Klebsiella pneumonia*, *Proteus vulgaris*. [92,93.]

Anti-fungal activity

The plant extracts shows a strong inhibitory activity against several fungi like *Trichophyton mentagrophytes*, *T. rubrum*, *T. soudanense*, *Candida albicans*, *Torulopsis glabrata*, and *Candida krusei*, *Aspergillus Niger*, *A. flavus*, *Penicillium sp.* and *Trichoderma sp* [94].

In Opium addition and opium poisoning

Celastrus paniculatus acts as potent antidotes for opium. It can relief people from opium addiction. It is unique Ayurvedic medicine which helps in opiate withdrawal. The signs like anxiety increased tearing, muscle aches, sleeplessness and watering of nose are control with *Celastrus paniculatus*. With this, *Vishtinduk vati* should also be given. Both medicines should be given with cow's ghee and milk. [95]

Immune modulatory activity

Kallakunta salomi, s.saba shafeen suggest that petroleum ether extract of seeds of *Celastrus paniculatus* stimulates humoral immunity as indicated by increase in antibody titre and cell mediated immunity as shown by mean percentage increase in paw volume. An increase in percent of RBC count, WBC count, hemoglobin percentage, phagocytosis and oxidative stress parameter such as superoxide dismutase, catalase, reduced glutathione and decrease in lipid peroxidation activities was observed. These finding

lead to the conclusion that *C. paniculatus* has significant Immunomodulatory and antioxidant property.^[96]

Anti-depressant activity

Feroj a. wani observed that the petroleum ether extract of *C. paniculatus* seeds was found to reduce the immobility period in forced swimming test and tail suspension test and reverse the reserpine induced extension of immobility in mice. Similarly to imipramine (IMI), the test drug extract reversed the degree of ptosis and catalepsy induced by reserpine in rats. These result suggests that the drug possesses antidepressant activity, the mechanism of action and the ingredient responsible for the action.^[97]

Iron chelating activity

Yash j Nakhva suggests that the methanolic extract of *c. paniculatus* have significant iron chelating activity. it also has beneficial effect on hematological parameters and organo-protective effects. So it can be beneficial in the management of iron overload disorders like thalassemia and hemochromatosis like condition.^[98]

Toxicity

The LD 50 cut-off dose for petroleum ether extract and alcoholic extract were found to be 5000 mg/kg and 3000 mg/kg body weight respectively during the acute oral toxicity study was conducted as per the guideline set by the Organization for Economic Co-operation and Development (OECD). Since one tenth of the medium lethal dose (LD 50) was considered as an effective dose, the therapeutic doses were taken as 500 mg/kg and 300 mg/kg body weight for petroleum ether and ethanolic extracts respectively^[99]

Recent study

Celastrus paniculatus has long been used in Ayurvedic medicine for its medicinal properties, modern medicinal studies have only confirmed the miraculous potential of *Celastrus* seeds in supporting mental function. According to the latest research conducted on albino rats, oil extracted from the seeds of *C. paniculatus* was observed to have remarkable effects on the contents of norepinephrine (NE), dopamine (DA) and serotonin (5-HT) in the brain ^[100] Significant improvement was observed in the retention ability of the drug treated rats. These data show that *Celastrus* oil result into an overall reduction in the three central monoamines and involve the contribution of

these aminergic systems in the learning and memory process [101]. Ongoing research There are researches being conducted to find out the option that anticancer drugs like pristimerin, which is derived from the seeds of the *Celastrus* plant, may be an effective means of treating or inhibiting the growth of specific types of cancer cells. H. Yang et al., who observed the research on pristimerin has found it to be quite active against nine cancer cell lines.[102] Many more such researches are still going on and the potential health benefits of *C. paniculatus* looks very promising.

Conclusion

As *Jyotishmati* is a *Medhya rasayana*, it is widely prescribed as brain tonic by ayurvedic physician. It contains phytochemical compounds like Alkaloids, Carbohydrates, Sterol, Triterpenoid phenolic compound, Flavonoid, Tannins, Saponins Celapagin, Celapaningin, Celapanin etc. which are responsible for many pharmacological activities like Antioxidant, Analgesic, Anti-inflammatory, Hypolipidaemic, Anti-arthritic, Wound healing, Anti-malarial, Anti-bacterial, Anti-fungal, Anti-fertility, anti-convulsion, Antidepressant, Immunomodulatory, Iron chelating activity etc. From ancient time *Jyotishmati* has been used as curative agent in many diseases. Hence, there is necessity to investigate the biological activity of its phytoconstituents at molecular level for development of an effective, safe and cheap herbal drug. The activity of this plant on modulation of biological axis and neurotransmitters necessitates further investigation. It is listed as 'vulnerable and endangered' medicinal plant. So realizing the threat of its extinction and to meet the growing requirement, the particular attention is needed towards conservation and propagation of *Jyotishmati* by scientific efforts.

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How to cite this article:

Pansare Tabassum Arif* Satpudke Shweta shaligram and Khandekar Surekha Babasaheb: Profile of Jyotishmati (*Celastrus Paniculatus* Wild): A review; *International Journal of AYUSH 2018:7(3) 851-866*.