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Review Article

MULTITUDE ACTIVITY OF MARSILEA MINUTA LINN: A REVIEW

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ABSTRACT

Sunisannaka (*Marsilea minuta*), also called dwarf water-clover, is an important drug belonging to marsileaceae family. It is widely available all over India and are the species of aquatic fern. It contains several nutritive chemical compositions and possesses pharmacological activity that are beneficial for several somatic and psychiatric issues of the body. Due to its huge availability, several therapeutic and Indian kitchen recipes are remarkably efficient to cure psycho-somatic diseases. Sleep being a factor of health besides physical activity if poor might decline the health significantly and leads to activation of ROS and produce various systemic diseases such as hypertension due to inflammation. Terpenes, sesquiterpenes, alkaloids etc. present in Sunisannaka (*Marsilea minuta*) has free radical scavenging enzymes and defense against oxidative stress and help to restore the sleep and maintain normal blood pressure.

Key words: Alkaloids, Benzoic acid, ethyl ester, endothelial dysregulation, farnesol, *Marsilea minuta*, oxidative stress, Sunisannaka

INTRODUCTION

Description of drug¹

Botanical name: *Marsilea minuta linn*

Family – marsileaceae

Classical name – Sunisannaka

Sanskrit names – Sunisannaka, Catuspatri

Regional names – Choupatiya, sunasuniya (hindi), susani shak (Bengali), arai-kirai (Tamil), mudugo-tamara (Telugu), chitigina soppu (Malayalam), papalu (Kannada), godhi (Punjabi), water clover, pepperwort (English)

Habitat²

The plant is an aquatic leptosporangiate fern (pteridophyte) and is highly advanced among pteridophytes groups of plants.

The Small herbaceous plant shows profuse vegetative growth with largest nodes in the rhizome.

The Leaves are long petiole, with leaflet 4, entire or crenulate measuring 3-3.5 cm in length. Leaves arise as bunches from the nodes of stem and grow up to tip. Each leaflet is broad and round in length. Veins radiating branched and marginally united as a loose network.

Sporocytes bean-shaped, measuring 8*5mm and pedicel 7-11 mm in length. Sporocarps brown, shortly stalked arise in branches from node along with the leaves.

Flowering and fruiting (sporocarp) season – plant bears sporocarps during autumn-cold season (November-January)

Distribution

Plants commonly grow in marshy and shady places by the side of rivers and in rice fields of west Bengal. A cosmopolitan distribution of the genus *Marsilea* species is widely seen.

Chemical Composition³

Non-protoplasmic cells contain contents like alkaloids, tannin, sugar, starch, fat, protein and mucilage in both leaf and sporocarp. Saponin and cutin are present in the sporocarp and lignin is present in leaf only. The leaves have marsilin.

The leaves were successively extracted with petroleum ether fraction yielded form and ethanol. The petroleum ether substance identified as 3-hydroxy-triacontan-11-one and a mixture of secondary alcohol with hentriacontane -16-01 as the major components. The chloroform extract has beta- sitosterol and the alcoholic extract a saponin which was founded as a mixture of sapogenol on hydrolysis process. Marsileagenin A, the mature of sapogenol was found to be olean-12-ente-2a, 3B. Calcium and phosphorus content are also found.

It also contains phenolic compounds such as Benzoic acid, farnesol acetate, terpene compounds(sesquiterpene), ethyl ester, oleic acid.

Rasa Panchaka	
Rasah: Kashayarasah, Madhurarasah	Virya: Sita
Gunah: Laguh, Snigdha	Vipaka: katuh
Doshah karma: Tridoshajahgna	Roga Karma: Arshogna, Dipanam-Grahi, Rakta Sodhana, Kasahara, Vrushya, Visagna, Medhya-Nidrajanan- Vedanahara
Rogah Nivarana: Arshah, Vataraktah-Urustambah, Kasa, Agnimandyam, Raktavikarah, Vatajaksana- Svasah, Sukrakshayah, Vishah, Timira Rogah and Manasa Rogah - Nidranasah	

Therapeutic uses of the plant

- The plant drug acts as a nerve tonic in the treatment of epilepsy and insomnia disorders.
- The leaves are a remedy for carbuncles.
- The plant acts with the antivenom property.
- Due to its anodyne, brain tonic, astringent, aphrodisiac properties, it is very much useful in insomnia.
- The plant is also useful in treating spermatorrhea, cough, asthma, eye disease.

Pharmacological Activity⁵

The chemical compositions such as

- Ethanolic extract of *Marsilea minuta* linn has the effect as CNS -depressant and for hypothermia.
- The aqueous and alcoholic extracts of leaves of *Marsilea minuta* significantly increases brain serotonin content. it also inhibits acetylcholinesterase in cerebral tissue of gamma aminobutyric acid (GABA) and increase the glutamine and glutamic acid levels.
- The leaves show mild degree of antifungal activity against *Alternaria alandi*, *Fusarium nivale*, *Gliocladium phomopsis* and *Gibberella* spp. Optimum anti-bacterial activity are also proven.

Therapeutic preparations

- Leaves roasted in ghee eradicates the bilious infection and insomnia conditions.
- The mature spores with buttermilk act on various urinary problems.
- The vegetable of herb (Sunishannaka saka) with ghee helps in treating conditions such as intrinsic hemorrhage (asrapittah) as sunisunnaka considered, wholesome (pathyasaka) in raktapitta.
- The sunishannaka drug plant as vegetable when cooked without salt used for urustambah.
- Pathyahara saka (medicated vegetable in diet) are also classically mended for cough (vatajakhasa), eye diseases (netrarogah), poisoning (vishah), intrinsic hemorrhage (asrapittah), gout (vataraktah).
- The sunishannaka plant along with changeri ghrita also prescribed in management of hemorrhoids (arshah).

Indian kitchen recipe of Sunishannaka plant

Recipe I – Sunsuniya Bhaji

Ingredients	
Sunishannaka leaves – 250 grams	Red lentil – ½ cup
Tomato – 2 nos.	Salt – q.s
Oil- q.s	Onion – 1nos.
Garlic- 1 nos.	Red chili – 2 no

Method of Preparation

Take a pan, cook the red lentil in water, and add the freshly cleaned sunishannaka leaves and sauté well and allow it to cook for 5 mins. After that, add paste of tomato and allow it to cook. Take another pan, add mustard oil, cut pieces of onion, garlic and red chilli and saute well. Add this mixture with the sunishannaka leaves. Sprinkle salt adjusting to the taste and serve hot. Sunsuniya bhaji is ready.

Recipe no II – Sunsunia Saga Bhaja

Ingredients	
Onion – 1 nos.	Mustard – 1 tsp
Red chili – 2no.	Jeera – 1tsp
Green chili – 1 nos.	Sunishannaka leaves – 1 cup
Mustard oil – 3 tsp	Salt – q.s

Method of Preparation

Take a pan, add mustard oil, mustard, jeera, red chili a onion and sunishannaka leaves. Sauté well. Finally add the required quantity of salt as per the taste and serve hot.

Indispensable of *Marsilea minuta* Linn in insomnia and hypertension

Sleep and A free radical flux theory is proposed in which the free radical in cerebral region accumulate during a wakefulness and are removed during sleep. The increased efficacy of endogenous antioxidants decreases the rate of formation of free radicals while sleep.

Free radicals are very reactive and unstable molecule fragments that have unpaired electron and can produce new free radicals.

Melatonin is a powerful, endogenous scavengers of ROS include particularly hydroxyl radicle, peroxy nitrite anion, nitric oxide. It increases the effectiveness of antioxidants such as superoxide dismutase, glutathione peroxide and catalase. Hence, melatonin produced while sleep has protective effect and also stimulate or activate DNA repair process.⁶

Relation of gut hemostasis with ROS causing insomnia and hypertension

The gut hemostasis depends on physiological level of locally produced ROS that regulate proliferation of specific stem cell and also the function of intestinal immunity.

NOx enzyme is hyperactivated by intestinal dysbiosis which alters the gut microbial profile. In insomnia, due to deprived sleep there are relevant gut microbial changes. Lack of sleep or sleep disorders like insomnia accumulate intestinal ROS that have systemic effect on alteration of gut microbiota profile. Besides it also triggers systemic inflammatory response independently of microbiota.

The inflammatory markers produced due to lack of sleep cause an increase in inflammatory molecules such as CRP, Cytokines, interleukins. β - amyloid protein in frontal brain as insomnia impairs the non-REM. Further it also causes endothelial dysregulation and thus activates renin-angiotensin system and produces hypertension.

Role of *Marsilea minuta* linn in insomnia and hypertension ROS scavenging activity of *Marsilea minuta* in insomnia and hypertension

Terpenes present in *Marsilea minuta* linn decreases the nitric oxide production in lipopolysaccharide (LPS). It also hinders the ability of the compounds responsible for the cytokine expression and inflammation in insomnia and hypertension. The terpene molecules have sedative effects on the sympathetic nervous system, as on absorption into the blood stream, it inhibits the dopamine metabolism that is induced by immobilization stress and the sedative effect occur due to inhibition of dopaminergic neurotransmission and modulation of neural activity in hypothalamus lateral area of the brain.⁷

Sesquiterpene also has regulatory effect on nitric oxide (NO), it also has the direct dose dependent scavenging activity on NO, protect cardiac tissue from the oxidative stress induced cell injury and lipid peroxidation and interfere with DOX -induced inflammatory and apoptotic induction in cardiac tissue due to hypertension.

Alkaloids present have effect on NADPH oxidase (Nicotinamide adenine -di-nucleotide phosphate), the biochemical produced due

to vascular oxidative stress and it upregulate the humoral and mechanical signals and produce the inflammation causing systemic illness like insomnia and hypertension. The alkaloids do the activation of the nuclear factor Nrf2 pathway for inhibition of NADPH-oxidase. And alkaloids can behave both as antioxidants and pro-oxidants and thus have effects on the key enzyme responsible for reactive oxygen species production, at the cellular level due to insomnia and hypertension.⁸

Benzoic acid (2-hydroxy-4-methoxy benzoic acid)- Free radical scavenging enzymes such as benzoic acid are the first line of defense against oxidative injury. Due to presence of benzoic acid, the deleterious effects such as loss of cell membrane integrity and membrane function in insomnia and hypertension are restored.⁹

Oleic Acid regulates the antioxidant defense mechanisms are necessary to manage the oxidative challenge and make sure of their protective effect for higher cell viability. Oleic acid also

provides protection to the endothelial cells in order to endure an oxidative challenge. Improvement of endothelial dysfunction by polyunsaturated fatty acids (PUFA) are mediated by reducing expression of adhesion molecules and restoring NO bioavailability due to ROS.¹⁰

Transcription factors NF- κ B and CREB leads to increased expression of antioxidant enzymes, pro survival proteins or growth factor, and anti-apoptotic proteins to terminate ROS activity in the body.

Ferulic acid ethyl ester presents in *Marsilea minuta* and the ethyl ester phytochemicals induces hormesis action via specific signal pathways. Hence, the use of naturally occurring compounds to combat the oxidative and nitrosative stress could help in either preventing or treating the progression of this devastating disorder.¹¹

Scientific research on *Marsilea minuta*

Recent Research	Authors	Result
Antitussive, expectorant activity of <i>Marsilea minuta</i> L., an Indian vegetable ¹²	Rajachakraborty, Biplab d e, N. Devanna, and Saikat Sen	In this experiment, chemicals like ammonium liquor and sulfur dioxide were used to induce cough. He coughs latency period, which is the time interval between exposure to ammonia hydroxide or SO ₂ and appearance of cough, showed the potential of the MMM and EMM on delaying cough. The longer cough latency period showed potent effect of the extract on relieving cough and the less cough times exhibited its stronger antitussive effect.
Phytoconstituents, pharmacological activities of <i>Marsilea minuta</i> (marsileaceae) -an overview ¹³	R. Jasmin Sajinis. Prema and k. Chitra	<i>Marsilea minuta</i> has numerous activities and treat much illness such as Insomnia, mental disorders, kidney infection, skin Diseases, as diuretic, hepatitis, diarrhea, Bronchitis, diabetes, blood purifier and treatment of Piles and it possesses many biological effects like Anti-pyretic and analgesic, antidiabetic, antitussive, Expectorant, anti-amnesic, anti-aggressive, Antimicrobial, hepatoprotective, antifertility, anti-tumor, antioxidant.
Antibacterial and antifungal activities of leaf and stem of <i>Marsilea minuta</i> L. Against selected microbial pathogens ¹⁴	Govindaraj Sabithira, Rajangam Udayakumar	The results confirmed that the leaf and stem of <i>M. Minuta</i> possess antibacterial and antifungal activities, and this study is also concluded that it may be useful in the treatment of infectious diseases caused by bacteria and fungi. It is also hoped that this study would lead to the establishment of some bioactive compounds, which may be useful to formulate new and more potent antimicrobial
Effect of standardized extract of <i>Marsilea minuta</i> on learning and memory performance in rat amnesic models ¹⁵	Subrat Kumar Bhatta Misra	Establishes the anti-amnesic activity of <i>M. Minuta</i> and also suggests that EMM augment the acetylcholine function by anticholinesterase and muscarinic agonistic activity. In addition, inhibitory effect on serotonergic and noradrenergic function in brain may also be responsible for the observed anti amnesic effect.
Hepatoprotective effect of whole plant extract fractions of <i>Marsilea minuta</i> ¹⁶	Divya balne, Praeetha pallerla, Swaroopa rani vanapatla, Ravi kumar bobbala	Retreatment with fractions (toluene, 1-butanol, aqueous at 50, 100mg/kg.b.w) significantly reversed the changes in serum biochemical parameters and histology of liver caused by the three hepatotoxins namely ccl ₄ , paracetamol and ethanol indicating their hepatoprotective activity.
Analytical profile and <i>in vitro</i> antimicrobial activity on leaves of <i>Marsilea minuta</i> Linn. (Marsileaceae) ¹⁷	Modak Dwiti	In the antimicrobial activity, methanol extract of leaves bears best activity against gram positive bacteria <i>Staphylococcus aureus</i> as well as gram -ve bacteria <i>Escherichia coli</i> and <i>Pseudomonas aeruginosa</i>

CONCLUSION

Lifestyle is a valuable resource for reducing the incidence of health problems. Good nutrition, physical activity and healthy weight and the BMR are significant factors for overall health and well-being. Food being the essential part of nutrition, and it is also a powerful tool in prevention and treatment of diseases. Thus, *Marsilea minuta*, a common fern with rich source of several vital minerals and a powerful antioxidant protects the body from harmful Free radical with its neutralizing molecules especially in stress related insomnia and hypertension. This, also being used as Indian kitchen recipe, provide a well-balanced diet and nutrition thus keeps the human body strong and healthy and therapeutically combat several diseases especially insomnia and hypertension.

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