Review Article

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Cyperus Rotundus Linn (*Mustaka*)

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Abstract

Rhizomes of *Cyperus rotundus* Linn.(Cyperaceae), extensively used in Ayurveda by the name of "*Mustaka*" for the treatment of digestive disorders, bowel disorders and inflammatory diseases, have been focus drug for ancient as well as present day scholars of Ayurveda. It contains essential oils, terpenes, flavonoids, beta-sitosterol and ascorbic acid. The main terpenes in *C. rotundus* are cyperenes, which include sesquiterpene hydrocarbons. Pharmacological studies have proved its efficacy as antiviral against hepatitis B virus, antimicrobial, antipyretic, anti-obesity and anti-allergic drug. This paper envisages evidence based information regarding classical therapeutic indications and pharmacological activities of this plant drug.

Keywords: *Cyperus Rotundus* Linn; *Ayurveda*; Phytochemistry; *Mustaka*.

Introduction

Ayurveda, the science of life, deals with the holistic view of healthy living. It covers patho-physiology of various diseases and their therapeutics. History of Indian Medicine reveals that several tough disease conditions have been treated successfully by administration of plant based formulations either as single drugs or in combination. Herbs are major component in all traditional medical systems, and a common element in *Siddha, Ayurvedic,* Homeopathic, Naturopathic, Traditional Chinese medicine and Native American medicine. According to World Health Organization, about 80% of world population rely chiefly on plant based traditional medicine for their primary healthcare needs [1]. Herbal drugs utilized in traditional healing systems around the world are an important resource for the discovery of modern drugs [2]. *Cyperus rotundus* Linn. (Family: Cyperaceae) has been a focus drug of *Ayurveda* with a promising therapeutic potential due to the presence of varied phytoconstituents. In Sanskrit, the plant is known as *Mustaka,* which refers to its gregarious nature. Another name *Nagarmotha* refers that it is found mostly near areas inhabited by man [3]. Other common names and synonyms are *Krodesta, Kachotha, Varida* (Sanskrit), *Motha* (Hindi), *Somad koophee* (Assamese), *Mutha* (Bengali), *Nagarmoth* (Gujarati), *Konnari Gadde* (Kannada), *Kari Mustan* (Malayalam), *Korai-kizhangu* (Tamil), *Tungamustalu* (Telagu), *Sadkufi* (Urdu) and Nut Grass (English) [4].

The genus *Cyperus* comprises more than fifty-two species that grow in damp or marshy places in India. The nut sedges inhabit tropical and subtropical areas. *C. rotundus* is indigenous to India, but now found in tropical, subtropical and temperate regions world over [5].

Observed health benefits may be credited to the presence of the various phytochemicals like polyphenols, terpenes, anthocyanins, flavonoids, alkaloids and glycosides.

Mustaka in Ayurvedic Classics

Charaka Samhita	*Lekhaniya, Triptighana, Kandhughna Stanyasodhana, Trishnanighraniya Mahakashya, Tliktaskandha gana*
Sushurata Samhita	*Vachadi, Mustadi gana*
Dhanwantri Nighantu	*Guduchyadi varga*
Sodhal Nighantu	*Guduchyadi varga*
Madanpal Nighantu	*Abhyadi varga*
Bhavaprakash Nighantu	*Karpuradi varga*
Raj Nighantu	*Piplyadi varga*
Shaligrama Nighantu	*Karpuradi varga*

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Ayurvedic Pharmacology (Guna-Karma)

It is based on biophysical, experiential, inferential and intuitional mechanisms. The action of a substance is based on five mechanisms of action or attributes of a substance, namely *rasa* (taste perception of the substance by the chemical receptors on tongue), *guna* (10 pair of opposite or mirror image attributes or properties of any substance), *vipaka* (assimilatory tissue metabolism; *madhura*-neutral, *amla*-acidic, *katu*-alkaline), *virya* (potency, *ushna*-hot, *sheeta*-cold) and *prabhav* (specific action through specialized receptors). All these mechanisms related to drug action are biophysical in nature. *Karma* is the action that involves the activity or performance. It is the final effect of drug. *C. rotundus* Linn. is used as anti-pyretic, anti-helimenthic, diuretic, digestive. The rhizome (tuber) is approved for use in medicine as listed by Ayurvedic Pharmacopoeia of India. Properties, actions (pharmacodynamics) and uses (indications) of *C. rotundus* Linn. are given below.[4]

Rasa	Katu,Tikta, Kash aya;
Guna	Laghu, Ruksha
Virya	S heeta
Vipaka	Katu
Karma	Sothahara, Dipana, Grahi, Tvakadosahara Krimighana, Pachana, Vishagahana, Pittakaphahara, Jwaraghna, Sthoulyahara, Trishnanigrahana,

Varieties [6]

Varieties	Names (Classical & Botanical)	References
3	Mustaka-*Cyperus rotundus* Linn.	Dhanvantari Nighantu (10thAD)
2 + 1	Nagarmustaka-*C. scariosus* R.Br.	Bhav Prakash Nighantu (16thAD.)
3	Kaivartamustaka-*C. esculentus* C.B. Clarke	Raj Nighantu (17thAD)

Morphology

Mustaka (Bhadramusta)[7] C. Rotundus Linn. (Fig.1)

Glabrous, stolons elongate, slender, 10-20cm. long, bearing hard ovoid tunicate black fragrant tubers 0.5-2.5 cm in diameter; root fibers clothed with flexuous hairs; stems subsolitary, 10-75 cm. long triquetrous at top, sometimes tuberous at base. Leaves shorter or longer than the stem, narrowly linear, 4-8 mm. broad, finely acuminate, flat 1-nerved. Umbel simple or compound; rays 2-8. The longest reaching 7.5 cm.long, bearing short spikes of 3-10 slender spreading red-brown spikelets, bracts 3, variable in length, the longest reaching 15 cm. long, but sometimes abbreviated and much shorter than the head. Spikelets variable in length, 1.6-3.8 cm. by 2.5 mm., linear, subacuate, red-brown, 10-50 flowered, compressed; rachilla with hyaline wings. Glumes 3-4 mm. long, oblong obtuse or slightly apiculate; back reddish brown, 3-7 nerved; Stamens 3; anthers 2.5mm. long. Nut 1.6 mm. long; stigmas 3, elongate, reaching 4 mm. long, much exserted.

Nagarmusta[8] C. Scariosus R.Br.; (Fig.2)

Glabrous, stolons slender, 0.8-5 cm. by 1.6mm., clothed by elliptic acute lax striate, concolorous scales 3 mm. long; stem long, slender, 40-90 cm. in height, triquetrous, at top 1-1.6 mm. diam. Leaves variable, usually short, less than one third of the stem, sometimes much longer, sometimes absent, narrow, weak. Umbel thin slender, contracted, rays slender sometimes up to 7.5 cm. long, Spikelets linear, pale straw- coloured, bracts nearly always as leaves, i.e. hardly any when leaves short, exceeding inflorescence when leaves long.

Kaivartmusta/ Jalmusta[9] C. Esculentus C.B.Clarke; (Fig.3)

An erect glabrous herb up to 50 cm. in height with slender subterranean stolons, more or less covered with acute rather hard strongly veined scales and ending in ovoid to cylindrical edible tubers up to 2 cm. in length. Stem – base pale brown, leaf sheath not fibrous, stem triquetrous, smooth finely striated. Leaf blade shorter than the stem, linear and gradually tapering in the upper part to a fine acuminate apex, 3-5 mm. in width. Inflorescence primarily umbel of sessile and peduncled spikes, the ray up to 7.5 cm. in length, primary bracts about 4, unequal, leaf like, the longest up to 10 cm. or more. Spikes rarely exceeding 2.5 cm., most often simple, the first glumes or secondary bracts of the lowest spikelets sometimes with a short narrow leafy blade. Spikelets linear, about 13 mm. long or shorter, 1.6 mm. wide; rachis slender with narrow hyaline wings. The two lowest glumes of each spikelet linear - lanceolate, acuminate. Flowering glumes boat - shaped, with a rounded or slightly emarginated apex, 3 mm long, 1.6 mm. in breadth when spread out, 3 lateral nerves on each side of the keel nerve. Stamens 3. Nut obovoid-ellipsoid in outline with 3 sharp angles, 1.6 mm. long.

Fig. 1: *C. rotundus* Linn

Fig. 2: *C. scariosus* R. Br

Fig. 3: *C. esculentus* C.B. Clarke

Phytochemistry

Phytochemical studies have shown that the major chemical components of this herb are essential oils, flavonoids, terpenoids and mono sesquiterpenes. The plant contains cyprotene, acopoene, cyperene, aselinene, rotundene, valencene, cyperol, gurjunene, trans-calamenene, d-cadenene, g-calcorene, cadalene, g-muurolene, cyperotudone, mustakone, isocyperol, a-cyperone[10], 4-11-selinnadien-3-one and 1-8-cineole[11]. The oil of C. rotundus mainly contains cyperol, α-cyperone, α-copenene, valerenal, myrtenol, β- pynene, α-pinene and α-selinene, sesqueterpene hydrocarbons (caryophyllene)[12-13].

Classical Uses

Fever

Water boiled with *musta, parpata* (*Fumaria indica* Pugsley), *ushira* (*Vetiveria zizanoidies* (Linn.) Nash), *candana* (*Santalum album* Linn.), *balaka* (*Pavonia odorata* Willd.) and *sunthi* (*Zingiber officinale* Roscoe) and cooled should be given to pacify thirst and fever[14]. *Parpata* mixed with *musta* or *sunthi* or *duralbha* (*Fagonia Arabica* Linn.) should be given in form of decoction or cold infusion[15].

Diarrhoea

Decoction of *musta* alone should be taken mixed with honey[16]. *Musta* rhizomes twenty (in number) should be boiled in milk with three times water reduced to milk. Its intake checks mucus and pain[17].

Halimaka

Lauha bhasma mixed with *musta* powder should be taken with decoction of *khadira* (*Acacia catechu* Willd.) in case of *halimaka*[18].

Erysipelas

Use of parched grain flour prepared with *musta* and *bhallatka* (*Semecarpus anacardium* Linn.), *maksika, devdaru* (*Cedrus deodara* Roxb.Loud.), *guduchi (Tinospora cordifolia* Miers ex Hook. f. & Jhoms.*)* and *shilajatu* is efficacious in glandular erysipelas[19].

Vatrakta

In *vatrakta* predominant in *kapha*, decoction of *musta, draksha* (*Vitis vinifera* Linn.) and *haridra* (*Curcuma longa* Linn.) mixed with honey should be taken [20].

Alcholism

Water boiled with *musta* should be used in all type of alcoholism.[21]

Loose Teeth

Mustaka is the main drug in *mustakdi vati* useful in disease.[22]

Eye Diseases

Bhadramusta rubbed with goat's urine is applied as collyrium. It destroys chronic corneal opacity and redness [23].

Clinical Study

Chronic Diarrhoea

Twenty patients with chronic diarrhoea of more than 3 weeks duration, or those in which there was early recurrence after an acute attack, were given 2 gm. of fine powder of *Cyperus rotundus* root tuber thrice daily along with 50 ml decoction made from 50 gm. tuber powder given daily for 15 days. The frequency of defecation was controlled by the fifth day of treatment. In addition it decrease fat mal-absorption and improved lactose intolerance. Forty percent of patients were considered cured, whereas there was improvement in thirty percent [24].

Conjunctivitis

In an open study, the effect of an aqueous solution of a methanolic extract of *Cyperus rotundus* tubers was studied in patients with conjunctivitis. Most of the patients were relieved pain and redness and considered cured after 5 days [25].

Folk Uses

1. Decoction of rhizome of *musta* with stem bits of *Tinospora cordifolia* Miers ex Hook. f. & Jhoms. *(guduchi)* and dried ginger is given to treat malarial fever[26].
2. Decoction of rhizome of *musta* along with leaves of *Fumaria indica* Pugsley, *Swertia chirata* (Roxb. Ex Flem.) Karst., black peeper (*Piper longum* Linn.) and ginger *(Zingiber officinale* Roscoe) used to treat typhoid fever [26].
3. Rhizome of *musta* juice is given in a dose of 25 ml thrice daily for 3 days to treat constipation [26].
4. The rhizome of *musta* are scrapped and pounded with green ginger mixed with honey prescribed in dysentery, gastric and intestinal troubles [27].
5. Fresh tubers of *musta* is applied to breast as a galactogogue [27].

Pharmacological Activity

Anti-Viral Activity

Kar et al reported that 24 weeks of medication with *C. rotundus* Linn. and *C. scariosus* R.Br. extracts (each 125mg) resulted in clinically significant virological and biochemical benefits in patients with chronic Hepatitis-B infection. A six months extended therapy gives comparatively better results in terms of viral clearance. The potential benefit of above mentioned extracts showed viral clearance including hepatitis-B surface antigen (HBsAg), hepatitis-B envelope antigen (HBeAg) and HBV DNA viral copies [28].

Anti-Microbial Activity

Essential oil (0.2%) extracted by hydrodistillation from the tubers of *C. rotundus* Linn. was found to be effective against various bacterial and fungal strains viz. *Bacilius subtilis, Escherichia coli, pseudomonas aeurioginosa,* and *Staphylococcus aureus, Candida parapsilosis, Aspergillus flavus, Aspergillus fumigatus and Fusarium oxysporum* in different concentrations [13].

Anti-Pyretic Activity

Alcoholic extract of *C. rotundus* showed highly significant ($P<0.001$) antipyretic activity against pyrexia produced in albino rats by the subcutaneous injection of suspension of dried Brewer's yeast in gum acacia in normal saline. A specific fraction obtained by chromatographic method from the petroleum ether extract was found to possess a significant anti-pyretic effect similar to acetyl salicylic acid when used on same animal model[29].

Anti-Obesity Activity

C. rotundus Linn. preparations (powder in fine suspension, aqueous and alcoholic extracts) exhibited a lipolytic action and mobilized fat from the adipose tissues in rats, thus helping to reduce the obesity[30]. A pilot study carried out on 30 obese people who were administered powdered tuber of *C. rotundus* for 90 days, showed reduction in weight along with a decrease in serum cholesterol and triglycerides [31].

Anti Spasmodic Activity

An aqueous extract of rhizomes of C. rotundus (ACR) was tested for its anti-diarrhoeal and anti-spasmodic activity. Anti –diarrhoeal effect of ACR was evaluated in castor oil induced diarrhoea in mice and antispasmodic effect was evaluated by charcoal meal test in mice at a dose of 125,250,500 mg/kg. The percentage inhibition of diarrhoea was 30.36%, 37.90%, 45.45% and 92.45% for ACR 125, 250 500 mg/kg (po) and loperamide 2 mg/kg dose (po) respectively. ACR 125, 250 500 mg/kg (po) and atropine sulphate 2 mg/kg dose (po) produced 24.35%, 31.48%, 36.75% and 55.94% inhibition of intestinal transit respectively. These results indicate that ACR produces its anti-diarrhoeal effect by

decreasing intestinal secretions and anti-spasmodic effect by inhibiting the intestinal motility[32].

Toxicological Study

C. rotundus Linn. is generally considered safe and often used to treat stomach complaints in children. In commonly used doses of 1-3 gm twice daily no adverse reactions have been reported [33].

Conclusion

C. rotundus Linn. (Musta) is one of the most versatile plants having a wide spectrum of pharmacological and medicinal activities. This versatile medicinal plant is the unique source of various types of compounds having diverse chemical structure. As the global scenario is now changing towards the use of nontoxic plant products having traditional medicinal use, a drug development programme should be undertaken to develop modern drugs with the compounds isolated from *C. rotundus* effective against different types of diseases.

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