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**UPDATED REVIEW ON CYPERUS ROTUNDUS (NAGARMOTHA)**

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**ABSTRACT**

Nagarmotha (Cyperus Rotunds) is also called as purple nut sedge or nut grass. And it belongs to the family cyperacea. The plant is widely distributed in India as well as other countries. And mostly used in ayurveda to treat several ailments it is used in several system of medicine for treating variety of diseases such as rheumatoid arthritis, whooping cough, strep throat, ear infection and urinary tract infection, cholera, tuberculosis, pneumonia, hepatitis, anxiety, depression, folliculitis. The numerous study proved the various pharmacological activities like anti-inflammatory, antipyretic, carcinogenic, analgesic, sedative, gastroprotective, anti-diarrhoeal, anti-emetic, tranquilizing, antidiabetic, wound healing, anti-bacterial, anti-convulsant, anti-malarial, anti-oxidant, anti-platelet, lipid lowering, anti-cancer, hepato-protective, anti-allergic activity it is full filled with nutritive value present the review aims to provide information related to chemical constituents with their morphology, pharmacological effect as well as their formulation of Cyperus rotundus.

**KEYWORDS**

Nagarmotha, Cyperus rotunds, Chemical constituents, Pharmacological activity and Formulations.

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**INTRODUCTION**

India is home to the Cyperus rotundus plant known as Nagamuthu. Its genus name, Cyperus, relates to the tuber and is derived from the ancient Greek name Cypeiros and the Latin word Rotundus, which means round<sup>1</sup>. One of the world's most unwanted weeds, it thrives in soils that retain moisture. It is a destructive weed that grows among agricultural, horticultural, and vegetable crops. It is a pestiferous perennial plant that grows from subterranean tubers and has dark green, glabrous culms. The plant produces rosettes of leaves, scapes, and umbels above ground in addition to rhizomes, tubers, basal

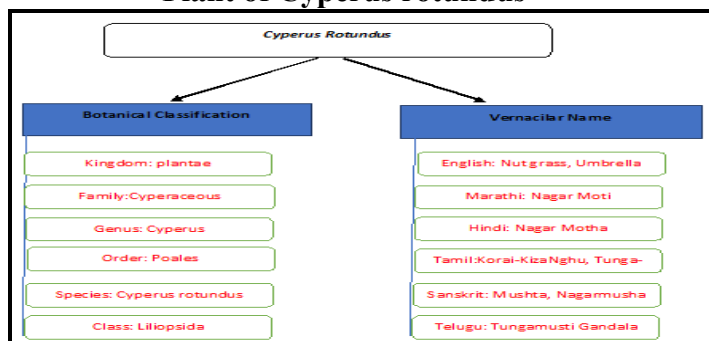
bulbs, and fibrous roots underneath<sup>2</sup>. Flavonoids, tannins, glycosides, furochromones, monoterpenes, sesquiterpenes, sitosterol, alkaloids, saponins, terpenoids, essential oils, starch, carbohydrates, protein, separated amino acids, and numerous other secondary metabolites were found in *Cyperus rotundus*, according to phytochemical analyses. It shows insecticidal, antibacterial, antioxidant, anticancer, neuroprotective, analgesic, hypolipidemic, weight-controlling, antiplatelet, gastrointestinal, hepatoprotective, antidiabetic, anti-dysmenorrhea, dermatological properties and many more. The goal of this review was to draw attention to *Cyperus rotundus*'s chemical make-up and pharmacological effects<sup>3</sup>.

### Morphology of *Cyperus rotundus*

It has long, ellipsoid-shaped rhizomes that can grow up to 60cm high, are sometimes tuberous, are black in colour, and have a distinctive aromatic flavour and aroma. The leaves are 2-6mm wide, the spikes are ovate and have rays that are up to 6cm long. The spikelets are linear 1-2cm long and have 12-30 flowers, the rachilla is winged; scales are purple, carinate, and obtuse 1.5mm long, sub-obovoid, trigonal, black, and minutely papillate achene<sup>4</sup>. The rhizome is 1.5-3cm long and 0.8-1.6cm in diameter. It has elongated, 1.5-3.5cm long stolons. The rhizome is cream-colored within and has a dark brown or black outside. The rhizomes are bluntly conical and have several wiry, strong, slender roots that are frequently joined by a thin, tough connective tissue. Each rhizome in the tumucate varies in size and thickness and it is capped by the stem and leaf remnants, which have turned into a hairy to scaly coating<sup>5</sup>.



Plant of *Cyperus rotundus*



### Chemical constituents

*Cyperus rotundus* has a lot of secondary metabolites, including sesquiterpenes (with diverse skeletons such as patchoulane, rotundane, eudesmane, guaiane, cadinane and caryophyllene types), flavonoids (visnagin, khellin, ammiol, isorhamnetin and triclin), coumarins and steroids (steroidal glycoside, sitosteryl-(6'-hentriacontanoyl)- $\beta$ -dgalactopyranoside), saponins, alkaloids, phenolic acids (salicylic acid, protocatechuic acid, caffeic acid and *p* coumaric acid)<sup>6</sup>. The percentage of essential oils in *Cyperus rotundus* tubers was (0.19%), with a specific gravity (0.9689) and refractive index (1.54051). *Cyperus rotundus* was collected in Egypt, and 52 different compounds were extracted. The main components of *Cyperus rotundus* oil were (+) oxo- $\alpha$ -ylangene (9.35%), (+)  $\alpha$ -cyperone (9.07%), trans-pinocarveol (7.92%), and cyperene (7.83%). However, the essential oils isolated from the tubers of *Cyperus rotundus* and their percentage were:  $\alpha$ -pinene 2.87, cyclopentene-3-ethylidene-1-methyl 0.24, sabinene 0.43,  $\beta$ -pinene 2.13, *p*-cymene, 0.18, 1-limonene 0.28, 8-cineole 0.36, trans-pinocarveol 7.92,



Rhizomes of *Cyperus rotundus*

terpinen-4-ol 0.59, citronellal 0.76, 4, 4-dimethyl-tricyclo-(3, 2, 1) octan-6-one 1.56, *p*-cymen-8-ol 1.96, 1- $\alpha$ -terpineol 1.45, *cis*-dihydrocarvone 0.38, myrtenol 1.86, verbenone 1.55, 1- $\beta$ -4, 4-trimethyl-bicyclo (3, 2) hept-6-en-2-ol - 1.05, *trans*-carveol 0.48, carvone 1.95, carvenone 0.32,  $\alpha$ -cubebene 0.40, dihydro-carvylacetate 0.93,  $\alpha$ -copaene 3.02, isolongifoline 1.66, cyperene 7.83, *trans*-caryophyllene 3.08, dihydroaromadendrene 1.47, aromadendrene-epoxide 2.51, naphthalene, 1, 6-dimethyl-4-(1-methyl ethyl) 1.09,  $\alpha$ -silenene 0.55, *cis*-calamenene 0.42, *trans*-calamenene 0.57, elema-1, 3, 11 (13)-trien-12-ol 0.64, caryophyllene-oxide 2.86, *cis*-12-caryophyll-5-en-2-one 2.4, caryophylla-2(12), 6(13) dien-5-one 1.95, cyclohexane, 1,1,2-trimethyl,3,5 bis- 1-methyl ethyl) 0.97, cyclo-hexenone, 2, 3, 3-trimethyl (3-methylbutadienyl) 1.06, isopropyl, 4a  $\beta$ , 8a  $\beta$ -dimethyl 3.69, longiverbenone 1.09, 10-epi- $\alpha$ -cyperone 1.00, (+) oxo- $\alpha$ -ylangene 9.35, (+)  $\alpha$ -cyperone 9.07, caryophyllenol 2.11, vulgarol A 1.13, vellerdiol 0.77, aristolone 3.54, vulgarol B 0.98, ledenoxide 1.34, dimethyl-7-isopropenyl-bicyclo- Dec-1-en-3-one 2.95, longifolinaldehyde 0.27 and longipynocarvone 2.95<sup>7,8</sup>. However, essential oils represented 0.2% (w/w) in the *C. rotundus* tubers, growing wild in Isfahan province (Iran). Sixty natural compounds were identified from its essential oil. Sesquiterpene compounds represented the major component of the oil. Among the oil constituents, cyperene (16.9%), caryophyllene oxide (8.9%),  $\alpha$ -longipinane (8.4%) and  $\alpha$ -selinene (6.6%) represented the major components<sup>9</sup>. Total flavonoids contents in methanol extracts of *C. rotundus* (8.15-18.25mg CE/g of dry matter) were higher as compared to ethanol extracts (6.44-13.77mg CE/g of dry matter). Total phenolic contents in methanol extracts of *C. rotundus* (27.40-37.85mg GAE/g of dry matter) were also higher as compared to ethanol extracts (25.21-30.23mg GAE/g of dry matter)<sup>10</sup>.

### Pharmacological Activities of *C. Rotundus*

#### Anti-inflammatory

The alcoholic extract (70 percent alcohol) was shown to be beneficial against formaldehyde-

induced arthritis in albino rats and even had anti-inflammatory properties against carrageen an-induced oedema<sup>11</sup>. In a different investigation, albino rats with oedema caused by carrageenan demonstrated anti-inflammatory action from the petroleum ether extract of the rhizomes. The triterpenoid isolated from petroleum ether extract through chromatographic separation shown a highly powerful anti-inflammatory action<sup>12</sup>. The ability of an aqueous-methanolic extract of *Cyperus scariosus* (Cyperaceae) to prevent liver damage brought on by acetaminophen and CCl<sub>4</sub> was examined. The outcomes shown that pre-treatment of rats with plant extract (500 mg/kg) significantly decreased (P<0.05) the corresponding blood GOT, ALP, and GPT levels to 63±9, 192±31, and 35±8 respectively. The same dose of plant extract (500mg/kg) was able to significantly suppress (P<0.05) CCl<sub>4</sub>-induced rise in blood enzymes. The estimated values of GOT (serum glutamic-oxaloacetic transaminase), ALP (Alkaline phosphatase), and GPT were 207±95, 220±30 and 75±38, respectively. Additionally, the plant extract inhibited the lengthening of pentobarbital's sleep period caused by CCl<sub>4</sub>, supporting its hepatoprotectives. These findings support the plant's traditional usage in treating hepato-biliary illnesses by showing that it has hepatoprotective properties<sup>13</sup>.

#### Antipyretic activity

When albino rats were subcutaneously injected with a solution of dried Brewer's yeast in gum acacia in normal saline, pyrexia was induced. The alcoholic extract of *C. rotundus* shown extremely substantial (P<0.001) antipyretic action against this pyrexia. When applied to the same animal model, a particular fraction produced by chromatographic technique from the petroleum ether extract was discovered to have a strong antipyretic activity comparable to acetyl salicylic acid<sup>14</sup>.

#### Cariogenic properties

The tuber extract of *Cyperus rotundus* inhibited *Streptococcus mutans* growth and acid generation. *S. mutans* is recognised as the bacterium responsible for the development of dental plaque

and tooth caries. The same tuber extract also prevented *S. mutans* from adhering to saliva-coated hydroxyapatite beads. The tuber extract also blocked the glucosyl transferase enzyme, which produced water-insoluble glucan from sucrose<sup>15</sup>.

#### **Analgesic and sedative**

*Cyperus rotundus* extracts in aqueous, ethyl acetate, methanol, and TOF-enriched form (300, 150 and 50µg/ml) were tested for their analgesic activity in mice. The examined extracts showed evidence of peripheral analgesic activity by being able to lessen the mouse ear oedema brought on by xylene and the quantity of abdomen contractions brought on by acetic acid. There is no toxic effect recorded in the mice having a dose up to 300mg per kilogram of the body weight<sup>16</sup>. Isocurcumenol, a sesquiterpene isolated from *C. rotundus*, was the subject of a study that showed it acts as a benzodiazepine receptor agonist and, as a result, positively modulates GABAergic neurotransmission by improving the interaction of gamma-aminobutyric acid (GABA) with its receptor in animals. These findings offer a pharmacological rationale for the practical usage of *C. rotundus* as a sedative because GABA is an inhibitory neurotransmitter<sup>17</sup>.

#### **Anti rheumatoid arthritis**

200 rheumatoid arthritis patients participated in a double-blind experiment with crude powders of *Cyperus rotundus*, *Withania somnifera*, and their combination (1:1). For three months, each patient took a 500mg pill three times each day. A two weekly general assessment based on international standards (Morning stiffness for how long, grip power, articular index, how much escape analgesic was used, erythrocyte sedimentation rate, haemoglobin, rheumatoid factor titre and x-ray results) was performed throughout this time. *Withania somnifera* was less effective than *Cyperus rotundus*, and the combined impact of the two medications produced a greater response than a single medicine alone<sup>18</sup>. The findings of the experiments were reported at the III<sup>rd</sup> World Congress of Clinical Pharmacology and Therapeutics (IUPHAR), which was held in Stockholm, Sweden, in 1986. It has been

demonstrated to be successful in the treatment of arthritis<sup>19</sup>.

#### **Gastroprotective**

Rats exposed to ischemia and reperfusion-induced stomach mucosal damage were prevented by *C. rotundus* extract. Rats given 200 and 100mg/kg of *C. rotundus* had considerably reduced mean ulcer index than the control group<sup>20</sup>. Rats were used in the studies to determine the antiulcer effects of *Cyperus rotundus* crude extract at doses of (300mg/kg and 500mg/kg). Rats were given 300mg/kg of aspirin to cause ulcers. A substantial antiulcer effect was produced by crude extract<sup>21</sup>.

#### **Anti diarrhoeal**

When taken orally, the methanol extract of its rhizome (250 and 500mg/kg body weight) displayed substantial antidiarrheal action in mice with castor oil-induced diarrhoea<sup>22</sup>. The decoction of tubers exhibited anti-giardial activity, decreased bacterial invasion and adhesion to HEP-2 cells, and altered cholera toxin synthesis and heat labile toxin action. The *C. rotundus* decoction lacks significant antibacterial activity, and it works to prevent diarrhoea in ways other than by directly destroying the pathogen<sup>23</sup>.

#### **Anti-emetic**

The ethanolic extract of *C. rotundus* was reported to protect 50% of dogs against apomorphine-induced vomiting at a dosage of 128.1-11.6mg/kg<sup>24</sup>.

#### **Tranquilizing activity**

In several studies, the ethanolic extract of *C. rotundus* shown strong sedative properties. It decreased spontaneous motor activity, exacerbated the narcosis caused by pentobarbital, disrupted motor coordination, and eliminated the animal models' conditioned avoidance response<sup>24</sup>.

#### **Anticonvulsant**

Mice pretreated with an ethanolic extract of *C. rotundus* experienced considerable protection from leptazol and strychnine-induced convulsions<sup>25</sup>. The ethanol extract of rhizomes (100mg/kg, p.o.) significantly decreased hind limb extension and convulsion duration ( $p < 0.001$ ) and was equal to the doses of the usual medication's phenytoin (25mg/kg, i.p.) and diazepam (4mg/kg, i.p.). These

findings imply that the ethanol extract of its rhizomes is valuable for creating a powerful phytoconstituent for the treatment of epilepsy, and flavonoids found in the ethanol extract may be responsible for its anticonvulsant properties<sup>26</sup>.

#### **Antibacterial Activity**

Using the inhibition zone method, the antibacterial activity of Cyperus oil was investigated for a number of pathogens, including *S. aureus*, *Klebsiella pneumoniae*, *Proteus vulgaris*, *Streptococcus pyogenes*, *E. coli* and *P. aeruginosa* (Aromatogram). Each microbe's MIC and MBC were calculated. Gram-positive bacteria were particularly sensitive to the antibacterial effects of *C. rotundus* oil, whilst Gram-negative bacteria were less sensitive and *P. aeruginosa* and *P. vulgaris* were not responsive to the oil's antibacterial effects<sup>27</sup>.

#### **Antimalarial Activity**

The separation of patchoulone, caryophyllene oxide, 10, 12-peroxycalamene and 4, 7-dimethyl-tetralone from the tubers of the *C. rotundus* plant. The new ndoperoxide sesquiterpene, 10, 12-peroxycalamene, has the greatest antimalarial activity at EC<sub>50</sub> 2.33 10<sup>-6</sup> M, with the antimalarial activities of these compounds falling within the range of EC<sub>50</sub> 10<sup>-4</sup>-10<sup>-6</sup> M<sup>28</sup>.

#### **Antioxidant activity**

Amrita Bindu is a mixture of spices (*Piper nigrum*, *Piper longum* and *Zingiber officinale*), herbs (*Cyperus rotundus* Linn. and *Plumbago zeylanica*), and salts. The goal of the study was to assess each ingredient's antioxidant capacity against the free radical 2, 2'-azinobis- (3-ethylbenzothiazoline-6sulphonic acid). The following order of the components' antioxidant capacities was determined by the analysis: *Piper nigrum* > *Piper longum* > *Cyperus rotundus* > *Plumbago zeylanica* > *Zingiber officinale*. These findings demonstrate the promising antioxidant potential of Amrita Bindu, a salt-spice-herbal combination comprising *C. rotundus* Linn, against free radical-induced oxidative damage<sup>29</sup>.

#### **Antidiabetic activity**

In rats with alloxan-induced diabetes, oral treatment of the extract at a dose of 500mg/kg once daily for

seven days in a row dramatically reduced blood glucose level<sup>30</sup>. *Cyperus rotundus* effectively reduced fasting blood glucose levels in rabbits with normoglycemia and diabetes caused by alloxan (2.5ml/kg, orally of 10% of the aqueous decoction of tuber portions). Hypoglycemic effects started to show up within the first week of therapy and tended to get worse as treatment went on<sup>31</sup>.

#### **Wound healing activity**

The objective of the current study was to assess the ability of *C. rotundus* tuber extract to promote wound healing. In three different rat wound models-the excision, the incision, and the dead space wound model-wound healing activity of an alcoholic extract of tuber portions of *C. rotundus* was tested. When compared to the effects of a conventional medicine, nitrofurazone ointment (0.2% w/w NFZ), the extract ointments shown a significant difference in response in all of the aforementioned wound models in terms of wound contracting ability, wound closure time and tensile strength<sup>32</sup>.

#### **Antiplatelet activity**

By assessing their effects on rat platelet aggregations *in vitro* and *ex vivo*, as well as on the lengths of time that mice tails bleeding, *Cyperus rotundus* ethanolic extract (CRE) and eight of its component chemicals were shown to have antiplatelet properties. In the *in vitro* platelet aggregation investigation, CRE demonstrated substantial and concentration-dependent inhibitory effects on platelet aggregation caused by collagen, thrombin, and/or arachidonic acid (AA)<sup>33</sup>. When used to research *Cyperus rotundus*' impact on hemorrhagic changes in normal rats, it can enhance all hemorrhagic indexes, including erythrocyte electrophoresis, whole blood specific viscosity and plasma specific viscosity<sup>34</sup>.

#### **Lipid lowering activity**

In the current investigation, hyperlipidaemia was brought on by a high-fat diet since this condition is usually helpful for identifying substances that prevent the absorption, breakdown, and excretion of cholesterol. In comparison to the baseline value, feeding with a high-fat meal resulted in a substantial (P < 0.05) rise in serum total cholesterol (TC),

triglyceride (TG) and low-density lipoprotein (LDL) levels. High density lipoprotein (HDL) levels increased while on a high-fat diet, although this rise was not shown to be statistically significant. At the conclusion of the 15-day intervention period in the current investigation, administration of the normal dosage and other extract dosages resulted in a statistically significant ( $P < 0.05$ ) decrease in blood TC, LDL, TG and HDL values<sup>35</sup>.

#### **Anticancer activity**

Anticancer In research that employed neuro-2a cells to evaluate plants for tumoricidal properties, *C. rotundus* ethanolic extract was shown to have only mild to moderate anticancer activity (LC50=2.528-4.939mg/ml determined from dose-dependent cell death)<sup>36</sup>. Another investigation demonstrated that more potent against L1210 leukaemia cells line effects of *Cyperus rotundus* essential oil. This outcome was highly linked with higher apoptotic DNA fragmentation<sup>37</sup>.

#### **Hepato-protective activity**

Hepatoprotective effect was detected in the *C. rotundus* rhizome extract. Tetra-chloromethane improves the hepatoprotective properties and diminishes liver damage. By reducing the levels of the enzymes glutamic oxalo acetic aminopherase, glutamic pyruvic aminopherase, alkaline phosphatase, and total animal pigment in liquid body substances, the ester extract demonstrated a significant protective effect<sup>38</sup>.

#### **Anti-allergic Activity**

Valencene, Nootkatone, Caryophyllene  $\alpha$ -oxide,  $\beta$ -pinene, limonene, 4-cymene, and 1, 8-cineole are sesquiterpenes that were extracted from the ethanolic extract of the rhizomes of *C. rotundus* (CRE) and were shown to have anti-allergic action. Sesquiterpenes were shown to prevent the 5-LOX-catalyzed synthesis of LTs. Additionally, they prevented the release of  $\beta$ -hexosaminidase and subsequent degranulation<sup>39</sup>.

## **FORMULATIONS of NAGERMOTHA**

### **Herbal shampoo**

Nagarmotha is an ingredient in polyherbal shampoo, promoting hair growth and has anti-dandruff properties<sup>40</sup>.

### **Antiseptic soap cyperus rotundus**

*Cyperus Rotundus* antiseptic soap is a solid soap that uses *C. Rotundus* weed as an active substance because *Cyperus Rotundus* contains anti-oxidant, anti-bacterial, and anti-inflammatory properties. The bacteria-killing power of the three soap formulas has a higher value than commercial antiseptic soaps on the market, so the three *C. Rotundus* antiseptic soaps are categorized as capable of killing germs<sup>41</sup>.

### **Preparations for autoimmune diseases (Vidangadi Lauha)**

It is used for the treatment of anemia, obesity, amavatarheumatoid arthritis, prameha diabetes, etc<sup>42</sup>.

## **CONCLUSION**

A single medicine has the potential to effectively treat a variety of ailments, according to our traditional texts. Therefore, it has to be verified scientifically to show that the ideas expressed in our classic literature are accurate. A significant traditional Indian medicinal herb called *Cyperus Rotundus* is employed in a variety of medical procedures. Today's society urgently needs the standardisation of drugs in terms of contemporary parameters employing cutting edge methods and pertinent equipment. The moment is opportune to continue researching this herb tremendous healing capabilities for the good of humanity.

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## **CONFLICT OF INTEREST**

We declare that we have no conflict of Interest.

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