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AN UPDATE ON SIDDHA HERB KORAI (*CYPERUS ROTUNDUS*, L.): A REVIEW

K. Samraj^{*1}, S. Thillaivanan² and K. Kanagavalli³

Velumailu Siddha Medical College¹, Sriperumpudhur - 602105, Tamil Nadu, India.

Siddha, Tamil Nadu Medical Service², Sriperumpudhur, Tamil Nadu, India.

Department General Medicine, Government Siddha Medical College³, Chennai - 600106, Tamil Nadu, India.

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Correspondence to Author:

K. Samraj

Lecturer,
Velumailu Siddha Medical College,
Sriperumpudhur - 602105, Tamil
Nadu, India.

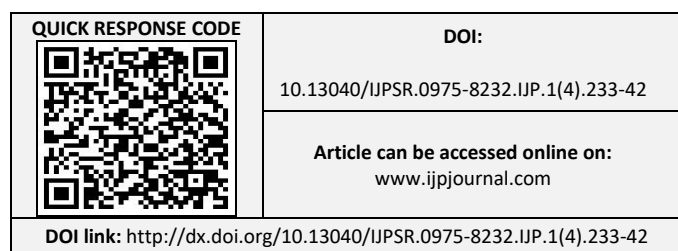
E-mail: drsam.md@rediff.com

ABSTRACT: The Siddha System of Medicine (Traditional Tamil System of medicine), which has been most prevalent in the ancient Tamil land, is the foremost of all other medical systems in the world. Since, ancient times, several diseases have been treated by administration of plant extracts based on traditional medicine. Plants are the only economic source of some well established and important drugs. Indian Materia Medica includes about 2000 drugs of natural origin. The National Siddha Formulary of India lists more than 10000 well practiced Siddha formulations described in Gunavagadam (Siddha pharmacology). *Cyperus rotundus* Linn. belongs to the family Cyperaceae. It is the world worst weed native to India. It has a wide range of medicinal and pharmacological applications. According to the Siddha, *C. rotundus* rhizomes are considered astringent, diaphoretic, diuretic, analgesic, antispasmodic, aromatic, carminative, anti-tussive, emmenagogue, litholytic, sedative, stimulant, stomachic, vermifuge, tonic and antibacterial. This paper provides a review of medicinal uses and various updated pharmacological properties of *C. rotundus* rhizome. The update is essential for developing the traditional system.

INTRODUCTION: The Siddha System of Medicine (Traditional Tamil System of medicine), which has been most prevalent in the ancient Tamil land, is the foremost of all other medical systems in the world¹. Siddha medicine has demonstrated path with a record of 10000 years and forms part of the Health Service, existing alongside conventional medicine². Medicinal plants are part and parcel of human society to combat diseases, from the dawn of civilization³.

According to the World Health Organization, 2003 about 80 % of the population of developing countries being unable to afford pharmaceutical drugs rely on traditional medicines, mainly plant-based; to sustain their primary health care needs⁴. Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs⁵. Also, they are also the source of chemical intermediates needs for the production of some drugs⁶.

One of the prominent Siddha herb 'Korai' (*Cyperus rotundus* Linn.) has a number of pharmacological and biological activities including anti-Candida, anti-inflammatory, anti-diabetic, anti-diarrhoeal,



cytoprotective, antimutagenic, antibacterial, and antioxidant, activities and it has some important phytochemicals like, flavanol, glycoside, saponin, phenol, terpenoids cardiac glycosides^{7,8}.

This medicinal plant is also reported to be effective as attenuate antidyspeptic, aromatic, nervine tonic; alternative, diuretic, astringent in Siddha literatures⁹. The rhizomes are initially white and fleshy with scaly leaves and then become fibrous, wiry, and very dark brown with age. *C. rotundus* is reportedly native to India, but it has been introduced around the World^{10, 11, 12}. Traditional Healers used its knotted tubers of black color for the cure of fever, diarrhea, dysentery, dyspepsia, anorexia, loss of appetite, vomiting, cholera, liver dysfunctions, and brain debility¹³.

The tuber part of *C. rotundus* is one of the oldest known medicinal plants used for the treatment of dysmenorrheal and menstrual irregularities. Infusion of this herb has been used in pain, fever, diarrhea, dysentery, an emmenagogue, and other intestinal problems^{14, 15, 16}. The present attempt is to review and compile updated information on various aspects of *C. rotundus* Linn. (Family: Cyperaceae). A plant used all over the world. This plant is commonly known as Nut Grass and abundantly available in tropical and subtropical areas. The ancient history of India describes its diverse uses and also plays an appreciable role in Siddha.

Plant Profile:

Vernacular Names:¹⁷

English Name: Nut Grass

Popular Names: Coco Grass, Purple Nut Sedge, Red Nut Sedge, Mustaka.

Common Indian Names:

Tamil: Korai

Telugu: Tungagaddi

Hindi: Motha, Mutha

Sanskrit: Bhadramusta, Granthi, Kachhda,
Mustako, Sugandhi-grant hill

Gujarati: Motha

Canarese: Koranarigadde, Tungegaddo, Tungehullu

Marathi: Bimbal, Nagarmotha, Motha

Scientific Classification:¹⁸

Botanical Name: *Cyperus rotundus*, Linn.

Synonyms: *Cyperus hexastachyos* Rottb.

Family: Cyperaceae

Kingdom : Plantae

Division : Magnoliophyta

Class : Liliopsida

Order : Poales

Family : Cyperaceae

Genus : Cyperus

Species : rotundus

Parts : Rhizomes

Habitat : Weed found all over India.

Botanical Description: It is a perennial shrub that attains a height of up to 40 cm. It has a dark green thin stem and the leaves are long and sharp, with a width of 1/6 to 1/3 inch. While the flower stem has a triangular cross-section, the flower is 2 to 8 inch in length, has three-stamina and a three-stigma carpel. It is also bisexual. The plant bears flowers in summer and fruits in winter. It has tuberous roots or rhizomes that are fragrant. A perennial, stoloniferous, rhizomatous, halophytic sedge. Rhizome many, slender; tuber-white, succulent when young, hard and black when mature; stem-leafy at base arising from a tuber. Culm-dark green, glabrous. Leaf dark green above, with reddish brown sheaths, clustered at the base of the stem. Inflorescence 3-9 is spreading rays bearing tassels of few, large spikelets; spikelet 20-40 flowered, red-brown to almost black. Fruit oblong ovate¹⁹.

Plant Chemicals: Several chemical compounds have been isolated from world's worst weed *C. rotundus*²⁰, and some of these chemicals possess medicinal properties and are used in Latin America, China, India and elsewhere^{21, 22, 23}. Various preparations of *C. rotundus* have been used for centuries in perfumes, spices and traditional medicines in India, China, Arab and Africa.

Different phytochemical studies on *C. rotundus* revealed the presence of alkaloids, flavonoids, tannins, starch, glycosides, furanochromones, monoterpenes, sesquiterpenes, sitosterol, fatty oil containing a neutral waxy substance, glycerol, linolenic, myristic and stearic acids²⁴⁻²⁷. The major compounds isolated from essential oil and the extracts of *C. rotundus* rhizome are alpha-

cyperone, alpha-rotunol, beta-cyperone, beta-pinene, beta-rotunol, beta-selinene, calcium, camphene, copaene, cyperene, cyperenone, cyperol, cyperolone cyperotundone D-copadiene, D-epoxyguaiene, D-fructose, D-glucose, flavonoids, gamma-cymene, isocyperol, isokobusone, kobusone, limonene, linoleic-acid, linolenic-acid, magnesium, manganese, C. rotunduskone, Myristic-acid, Oleanolic-acid, Oleanolic-acid-3-o-neohesperidose, Oleic-acid, P-cymol, patchoulene, pectin, polyphenols, rotundene, rotundenol, rotundone, selinatriene, sitosterol, stearic-acid, sugeonol, sugetriol^{28, 29, 30, 31}. *C. rotundus* contains an essential oil that provides for the characteristic

odor and taste of the herb, comprised mostly sesquiterpene hydrocarbons, epoxides, ketones, monoterpenes, and aliphatic alcohols. Sesquiterpenes include selinene, isocur-cumenol, nootkatone, aristolone, isorotundene, cypera-2, 4(15)-diene, and norrotundene, as well as the sesquiterpene alkaloids rotundines A-C. Other constituents include the ketone cyperadione, and the monoterpenes cineole, camphene, and limonene. *C. rotundus* has also been shown to contain miscellaneous triterpenes including oleanolic acid and sitosterol, as well as flavonoids, sugars and minerals^{32, 33}.

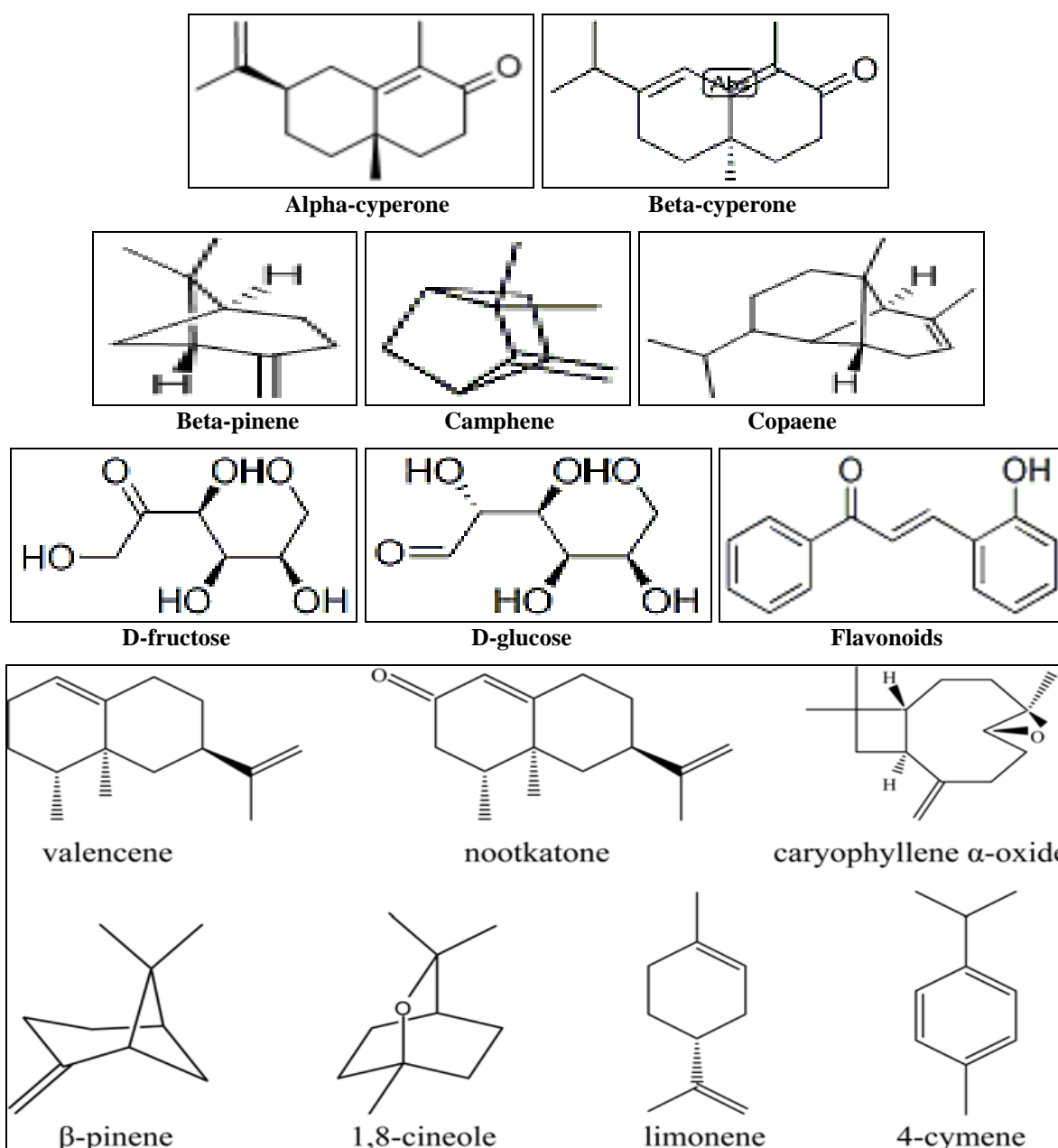


FIG. 1: SOME PHYTOCHEMICAL STRUCTURES^{34, 35}

Medicinal Uses: According to the Siddha, the rhizome is pungent, acrid, cooling, astringent, appetizer, stomachic, anthelmintic and useful in the treatment of leprosy, thirst, fever, blood diseases, biliousness, dysentery, pruritis, pain, vomiting, epilepsy, ophthalmia, erysipelas etc.³⁶

- The paste of nut grass is used in treating skin related ailments like scabies and eczema and helps in relieving itching.
- The paste is used in increasing the size of the breasts. It also purifies the breast milk, improves eyesight and helps in eye related ailments.
- The extract from the roots is instilled into eyes in conjunctivitis, to reduce the pain, redness and ocular discharges.
- Nutgrass, when taken in powdered form, improves digestive system, removes worms from the gastrointestinal tract, curbs infection and purifies the blood.
- The powder is massaged to reduce the subcutaneous fat deposition in case of obese people.
- It normalizes the menstrual disturbances and breast discomfort and maintains normal body temperature.
- Nutgrass proves useful in diseases like psychosis and epilepsy and mental diseases.
- The herb helps in healing wounds and uterine contraction and provides strength to the body.
- It is used as a diuretic to treat ulcers and as an emmenagogue and an ingredient in warm plasters
- Nutgrass is an effective remedy for distaste, vomiting, diarrhea, colitis, and dyspepsia.
- It is considered the best herb for treating any fever.
- The root is often used for developing high memory.
- Nutgrass is beneficial in treating cough and asthma since it alleviates the kapha.
- The herb harmonizes liver, spleen, and pancreas. It helps in curing thirst, bronchitis, dysuria and poisonous affections.
- It is often used as an insect repellent for perfuming clothing.
- It may be a good remedy for indigestion in the light of constituents present in it, for example, there are many enzymes for carbohydrates and minerals which act as a catalyst for various biochemical reactions and helps indigestion. It is also useful for the dietary management of psychotic diseases and metabolic disorders³⁷.
- They are used in treatment of Nausea and vomiting, dyspepsia, colic, flatulence, diarrhoea, dysentery, intestinal parasites, fever, malaria, cough, bronchitis, renal and vesical calculi, urinary tenesmus, skin diseases, wounds, amenorrhoea, dysmenorrhoea, deficient lactation, loss of memory, insect bites, food poisoning, indigestion, nausea, dysuria, bronchitis, infertility, cervical cancer and menstrual disorders and the aromatic oils are made of perfumes and splash³⁸⁻⁴².
- It is also an important ingredient of anti-pyretic preparation of Nilavembu Kudineer⁴³.

TABLE 1: MEDICINAL USES OF *C. ROTUNDUS*

S. no.	Activity	Plant Part/ Extract	Dose/ Model	Method	Standard Drug	Result
1.	Anti-inflammatory	Rhizome/ Alcohol	Albino Rats	carrageenan-induced edema	Hydro-cortisone	Showed highly significant (P<0.001) anti-inflammatory activity eight-time greater than that of hydrocortisone ⁴⁴
2.	Antipyretic activity	Rhizome/ Alcohol	Albino Rats	Pyrexia produced in rats by dried Brewer's yeast	Acetyl salicylic acid	Highly significant (P<0.001) anti-pyretic activity ⁴⁵
3.	Analgesic activity	Rhizome/ Petroleum Ether	300 mg/ Albino Mice	Tail-flick method	Diclofenac Na	Showed highly significant results (5±0.45 sec reaction time) ⁴⁶

4.	Tranquilizing activity	Rhizome/ Ethanol	-	-	-	reduced the spontaneous motor activity ⁴⁷
5.	Anticonvulsant activity	Rhizome/ Ethanol	100mg/kg, P.O.) /Mice	Leptazol induced convulsions	Phenytoin (25mg/Kg, I.P.) And Diazepam (4mg/Kg, I.P.),	Reduced hind limb extension and duration of convulsion significantly, (P<0.001) ⁴⁸
6.	Anti-Emetic activity	Rhizome/ Ethanol	128.1± 11.6 mg/kg/ Dogs	Apomorphine induced vomiting	-	⁴⁹
7.	Antispastic activity	Rhizome/ aqueous	500 mg/kg/ mice	charcoal meal test	atropine sulfate	55.94% inhibiting the intestinal motility ⁴⁹
8.	Inhibition of gastric motility activity	Rhizome/ Ethanol	Rats	-	-	inhibition of gastric motility and endogenous prostaglandins may play an important role ⁵⁰
9.	Gastroprotective activity	Rhizome/ Ethanol	200 and 100 mg/kg / Rats	Gastric mucosal injury induced by ischemia and reperfusion in rats.	-	gastric mucosal injury induced by ischemia and reperfusion: significantly lower than that of control ⁵¹
10.	Antidiarrhoeal activity	Rhizome/ aqueous	250 and 500 mg/kg / Mice	Castor oil induced diarrhea	loperamide	anti-diarrheal effect through decreasing intestinal secretions ⁵²
12.	Hypolipidaemic activity	Rhizome/ aqueous	Wistar Rats	CCl ₄ induced dyslipemia in rat	Simvastatin (5 mg/kg/day) and Fenofibrate (20 mg/kg/day)	Significant (P < 0.05) reduction in serum TC, LDL, TG, HDL levels at the end of 15 days of intervention ⁵³
13.	Hepatoprotective activity	Rhizome/ Ethyl Acetate	100 mg/kg / Rats	Inducing liver damage by carbon tetrachloride.	Silymarin	Significant protective effect by lowering serum levels of glutamic oxaloacetic transaminase, glutamic pyruvic transaminase, alkaline phosphatase, and total bilirubin ⁵⁴
14.	Anti-obesity activity	Rhizome/aqueous	-	-	-	lipolytic action and mobilized fat from the adipose tissues in rats, thus helping to reduce the obesity ⁵⁵
15.	Antiarthritic activity	Rhizome/aqueous	500 mg/kg/ Male Wistar rats	Formaldehyde induced arthritis	Diclofenac Na	⁴⁶
16.	Wound healing activity	Rhizome/alcohol	a form of ointment/ rats	-	Nitrofurazone	wound contracting ability, wound closure time and tensile strength ⁵⁶
17.	Antioxidant activity	Rhizome/ Ethanol	-	free radical 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulphonicacid) (ABTS)	-	exerts a promising antioxidant potential against free radical-induced oxidative damage ⁵⁷
18.	Anticancer activity	Rhizome/ Ethanol	-	Neuro-2a Cells	-	Have only weak to moderate anticancer activity (LC ₅₀ =2.528-4.939 Mg/MI)

19.	Anti-diabetic activity	-	500 mg/kg/ rats	alloxan-induced diabetes	-	calculated from dose-dependent cell death) ⁵⁸ Significantly lowered the blood glucose levels ⁵⁹
20.	Antimicrobial activity	Rhizome/ Ethanol	-	-	Amoxicillin	Moderate inhibition was observed in the case of <i>A. niger</i> and <i>S. aureus</i> (90 and 70% respectively) ⁶⁰
21.	Antibacterial activity	Rhizome/ aqueous	-	remarkable activity against gram-positive bacteria <i>Staphylococcus aureus</i> and <i>Enterococcus faecalis</i>	-	observed against <i>Salmonella enteritidis</i> , <i>Staphylococcus aureus</i> and <i>Enterococcus faecalis</i> ⁶¹
22.	Antimalarial activity	Rhizome/ Ethanol	-	<i>in-vitro</i> antimalarial activity against <i>Plasmodium falciparum</i>	-	⁶²
24.	Ovicidal and larvicidal activities	Rhizome/ oil	-	-	-	The results obtained suggest that the essential oils of these <i>Cyperus species</i> can serve as a potential source of natural mosquitocidal agents ⁶³

Macroscopy:

Organoleptic Characters: The fresh rhizome of *C. rotundus* Linn. was studied for organoleptic

characters such as appearance, color, odor, and taste⁶⁴. Organoleptic characteristics of *Cyperus rotundus* Linn Rhizome⁶⁵.

TABLE 2: ORGANOLEPTIC CHARACTERS

S. no.	Organoleptic Parameters	<i>Cyperus rotundus</i> Linn. Rhizome
1	Appearance	Coarse powder
2	Colour	Brown
3	Odour	Pleasant odour
4	Taste	Slightly bitter & astringent

Microscopy:

Preparation of Specimens:⁶⁶ The healthy rhizome was cut and removed from the plant and fixed in FAA (formalin - 5ml + acetic acid - 5ml + 70% ethyl alcohol - 90ml). After 24 h of fixing, the specimens were dehydrated as per schedule. Infiltration of the specimens was carried by gradual addition of paraffin wax (melting point 58-60 °C) until tertiary-butyl alcohol solution attained supersaturation.

The specimens were cast into paraffin blocks. The paraffin-embedded specimens were sectioned with the help of Rotary Microtome⁶⁷. Dewaxing of the sections was carried out by standard procedure and stained the method published by O'Brien *et al.*,⁶⁸. The photographs were taken through the microscope.

Physico-Chemical Analysis: Loss on drying, crude fiber content, total ash, acid insoluble ash, water soluble ash, sulphated ash water-soluble extractive, alcohol soluble extractive values were calculated as per Indian pharmacopoeia⁶⁹. Successive extractive values were observed with solvents of petroleum ether (60-80 °C), n-hexane, acetone, alcohol, aqueous^{70,71}.

Fluorescence Analysis: The petroleum ether, n-hexane, acetone, alcohol and aqueous extracts and the powder samples of rhizomes of *C. rotundus* Linn. were subjected to fluorescence analysis as per Chase and Pratt⁷².

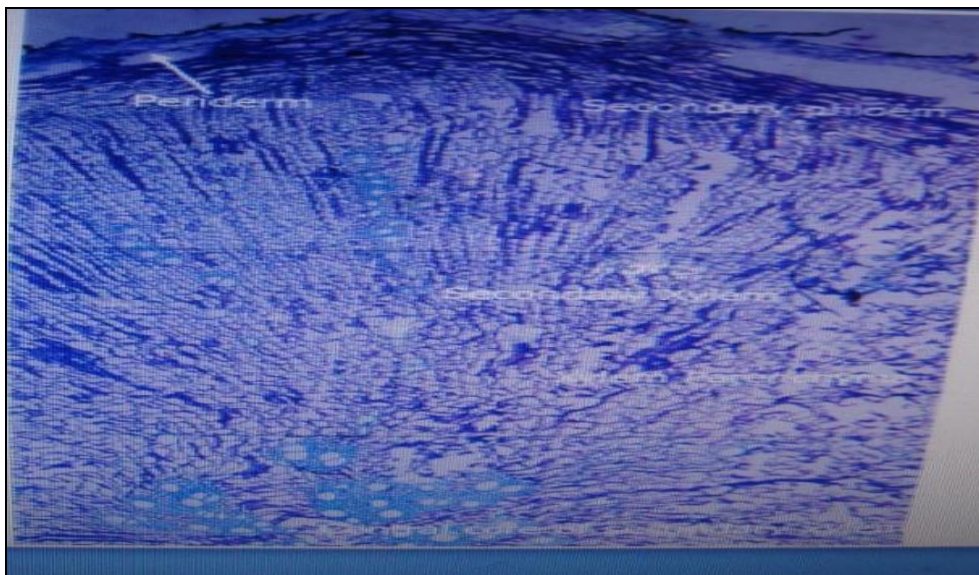
Fluorescence analysis of *Cyperus rotundus* Linn. rhizome⁶⁵.

TABLE 3: FLUORESCENCE ANALYSIS

Preparation Extracts	Day Light	UV Light
Petroleum ether	Pale brown	Dark Brown
n-hexane	Yellow	Yellowish green
Acetone	Brown	Brown
Alcohol	Yellow	Green
Aqueous	Light brown	Brown

Phytochemical Screening: The extracts prepared for the study were subjected to preliminary phytochemical screening by using different reagents for identifying the presence of various phytoconstituents like steroids, phenolic

compounds, flavonoids, glycosides, saponins, triterpenoids, alkaloids, anthraquinones, tannins, quinines coumarins and reducing sugars. The above phytoconstituents were tested as per the standard methods^{73,74}.

**FIG. 2: CYPERUS ROTUNDUS LINN. RHIZOME****FIG. 3: TRANSVERSE SECTION OF CYPERUS ROTUNDUS LINN, RHIZOME**

CONCLUSION: The widespread survey of literature exposed that Siddha herb *Cyperus rotundus* Linn. is highly regarded as a universal

solution in the herbal medicine with diverse pharmacological activity range. This Siddha medicinal plant is the unique resource of various

types of chemical compounds, which are responsible for the various activities of the plant. Hence extensive investigation is needed to develop their therapeutic utility to fighting diseases. As the global scenario is now altering towards the use of non-toxic plant products having traditional medicinal use, development of modern drugs from *C. rotundus* should be emphasized for the organizing of various diseases. Further, evaluation needs to be carried out on *C. rotundus* Linn. to discover the concealed areas and their practical clinical applications, which can be used for the benefit of mankind.

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CONFLICT OF INTEREST: Nil

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