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PHYTOCONSTITUENTS OF *CYPERUS ROTUNDUS* L. THAT ATTRIBUTE TO ITS MEDICINAL VALUE AND ANTIOXIDANT PROPERTY

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ABSTRACT

Cyperus rotundus L. is a medicinal herb widely used in the ancient Ayurvedic and Chinese traditional medicine. In the earlier investigations it has been primarily studied for its antioxidant properties. The present study explores the various phytochemicals present in the plant so as to substantiate its antioxidant property and also unravels the several phytoconstituents that contribute to its various medicinal properties.

INTRODUCTION: The medical uses of *Cyperus rotundus* L. have been exploited for thousands of years, especially in Chinese traditional medicine. The parts of *Cyperusrotundus* used are its rhizome, leaves, seeds and oil. It is a perennial grass-like herb growing up to 60 cm high with underground tubers, widespread through the warmer parts of the world. Ancient sage of India have considered it to be an appetizer, digestant, anti-diarrhoeal, anti-saturative, thirst relieving, anti-pruritic, reducing and lactodepurant herb. It is also well known for its diaphoretic properties.

Some of its phytochemical and pesticidal properties have been reported earlier [1]. Its *in-vitro* antioxidant activity and total polyphenolic content analysed earlier suggest that the plant could be used as a potential source of natural antioxidant [2]. Cyperus oil from Iraqi *C. rotundus* has been found to possess antibacterial activity [3]. This study elaborates the phytochemical constituents of the plant so as to ascertain the chemical constituents of the plant that attribute to its free radical scavenging property and various medicinal uses.

MATERIALS AND METHODS: The whole plants of *C. rotundus*L. at flowering stage were collected from CholayilVelagapuram farm, Chennai, India. They were dried in shade. A herbarium specimen of *Cyperusrotundus* L. (F. No: 3251) was authenticated and deposited at the Herbarium, Sri Paramakalyani Center for Environmental Sciences Herbarium (SPKCESH), Alwarkurichi, Tamil Nadu, India.

Preparation of the Methanolic Extract: The dried and powdered whole plant parts (which includes roots, rhizomes, flowers and leaves) of *C. rotundus*L. (500g) were incubated in Hexane, (1:3 ratio)for 48 hrs in a shaker. The extract was collected using Whatman No. 1 filter paper and the above procedure was repeated.

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The hexane treated residual mixture was extracted with Methanol in 1:4 ratios and collected using Whatman No. 1 filter paper and evaporated below 40°C. The above procedure was repeated, and the extract was used for further analysis. Phytochemical analysis was done to determine the chemical constituents of the plant.

Antioxidant activity or free radical scavenging activity of the ethanolic extract against 1,1-Diphenyl-2,Picryl-Hydrazyl (DPPH) was measured. DPPHwas purchased from Sigma, USA.

The percentage inhibition of DPPH radical by the sample was calculated using the following formula:

Inhibition % =

$$\frac{\text{(Absorbance of control (A517) – Absorbance of sample (A517)100}}{\text{Absorbance control (A517)}}$$

DPPH is a stable free radical with purple colour (absorbed at 517nm). If free radicals have been scavenged, DPPH would degenerate to yellow colour[4].

Preparation of sample for DPPH:

The extracts were dissolved in methanol in the concentration of 1mg/ml which was then used to determine its antioxidant activity.

BLANK : Methanol

CONTROL : Methanol + DPPH (0.1%)

TEST : Methanol + DPPH 100µl (0.1%) + 100µl (100µg) plant extract

STANDARD : Methanol + DPPH 100µl (0.1%) + 100µl (0.16%) BHT

Absorbance of free radical from DPPH AT 517nm was measured with blank : 0.000, control : 3.400

RESULTS AND DISCUSSION: The yield from the Crude extract of *C. rotundus*is as shown in Table 1.

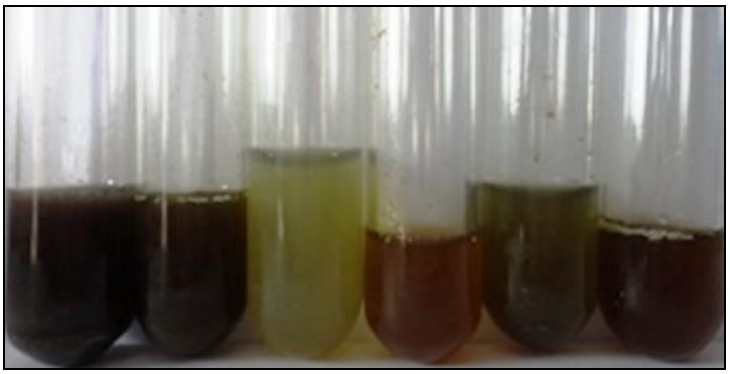
TABLE 1: YIELD FROM CRUDE EXTRACT

Sample	Solvent	Amount of Plant powder	Amount of extract
Plant material	Methanol	500g	7g

Phytochemical analysis of the methanolic extract of *C. rotundus*is as shown in **Table 2 and Figure 1**.

TABLE 2: PHYTOCHEMICAL ANALYSIS OF THE METHANOLIC EXTRACT OF *C. ROTUNDUS*

PHYTOCHEMICAL TEST	OBSERVATION
Carbohydrate test	Present
Tannins test	Strongly present
Saponin test	Strongly present
Flavonoid test	Strongly present
Alkaloid test	Strongly present
Anthocyanin and Betacyanin test	Presence of β cyanins
Quinones	Strongly present
Glycosides test	Absent
Cardiac glycosides test	Absent
Terpenoids test	Strongly present
Triterpenoids	Absent
Phenols	Strongly present
Coumarins	Present
Acids	Absent
Proteins	Present
Steroids and Phytosteroids	Presence of Steroids
Phlobatannins	Absent
Anthraquinones	Absent



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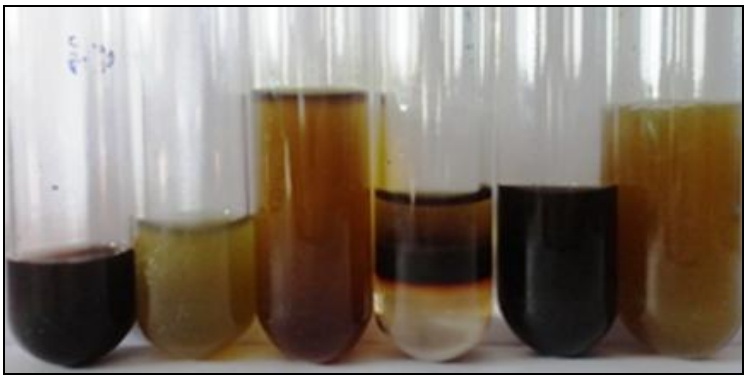

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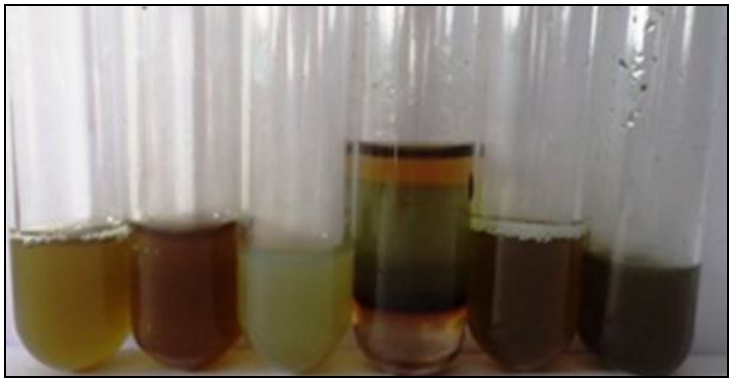

13 14 15 16 17 18

FIGURE 1: PHYTOCHEMICAL ANALYSIS OF THE METHANOLIC EXTRACT OF *C. ROTUNDUS*

1. Test for carbohydrates
2. Test for tannins
3. Test for saponins
4. Test for flavonoids
5. Test for alkaloids
6. Test for cyanins
7. Test for quinones
8. Test for glycosides
9. Test for cardiac glycosides
10. Test for terpenoids
11. Test for triterpenoids
12. Test for phenols
13. Test for coumarins
14. Test for acids
15. Test for proteins
16. Test for Steroids and phytosteroids
17. Test for phlobatannins
18. Test for anthraquinones

The presence of tannins, saponin, flavonoids, alkaloids, Quinones, terpenoids and phenols were found to be significant.

Historically, tannic acid was used along with activated charcoal and magnesium oxide in the "universal antidote," for poisoning. Tannins are popular for their protective effect on skin. They are also known to be anti-HIV [5], antibacterial [6] and antiparasitic [7]. The antipruritic activity of *Cyperusrotundus* can be attributed to the presence of tannins.

Saponins are surface active agents and can lyse erythrocytes in vivo. But its absorption after oral administration is considerably low [8]. They are used as adjuvants in vaccines [9].

Major flavonoids that show well categorized structures and well defined structure function-relationships areflavans, flavanones, flavones, flavanonols, flavonols, catechins, anthocyanidins and isoflavone. The biological properties of flavonoids include antioxidant, anti-inflamatory, antitumoral, antiviral and anti-bacterial, as well as a direct cytoprotective effect on coronary and vascular systems, the pancreas and the liver [10].

Pure, isolated plant alkaloids and their synthetic derivatives are used as basic medicinal agents for their analgesic, antispasmodiac and bactericidal effects.

Quinones are widely known as anti-microbial and anti-carcinogenic agents [11]. Quinone derivatives such as naphthoquinones, benzoquinines and anthraquinones are known for their various anti-infective properties. Vitamin K is a complex naphthoquinone with anti-hemorrhagic activity.

A number of terpenoids exhibit cytotoxicity against a variety of tumor cells. They are suggested to be potential chemopreventive and therapeutic agents in liver cancer [12].

Natural phenolic compounds play an important role in cancer prevention and treatment. Various bioactivities of phenolic compounds are responsible for their chemopreventive properties like antioxidant, anti-carcinogenic or anti-mutagenic and anti-inflammatory effects. They induce apoptosis by arresting cell cycle, regulating carcinogen metabolism and ontogenesis expression, inhibiting DNA binding and cell adhesion, migration, proliferation or differentiation, and blocking signaling pathways [13]. The presence of phenols is considered to be potentially toxic to the growth and development of pathogens.

The test for carbohydrates, betacyanins, coumarins, proteins and steroids also yielded a positive result, while the tests for glycosides, triterpenoids, acids, phlobatanins and anthraquinones gave a negative result.

Betacyanins are supposed to be anti-cancer agents. In betacyanins, glycosylation reduced the antioxidant activity while acylation generally improved the activity [14].

Phytosterols lower cholesterol levels by competing with cholesterol for absorption in the intestine. Considerable emerging evidence supports the inhibitory actions of phytosterols on lung, stomach, as well as ovarian and breast cancer. Phytosterols seem to act through multiple mechanisms of action, including inhibition of carcinogen production, cancer-cell growth, angiogenesis, invasion and metastasis, and through the promotion of apoptosis of cancerous cells [15].

Coumarins are strong antibacterial agents. Other activities reported for coumarins includes anti-HIV, anti-tumor, anti-hypertension, anti-arrhythmia, anti-inflammatory, anti-osteoporosis, antiseptic, and analgesic It is also used in the treatment of asthma and lymphedema [16].

The antioxidant activity of the extract was also found to be significant and is shown in **Table 3 and Figure 2**.

TABLE 3: ANTIOXIDANT ACTIVITY: ABSORBANCE OF FREE RADICAL FROM DPPH AT 517nm

S. NO.	SAMPLE	OPTICAL DENSITY					
		5'	10'	15'	20'	25'	30'
1	BHT (0.16%)	0.985	0.769	0.708	0.680	0.652	0.630
2	Sample (Methanol)	1.798	1.544	1.401	1.248	1.125	1.029

S. NO.	SAMPLE	% OF INHIBITION					
		5'	10'	15'	20'	25'	30'
1	BHT (0.16%)	71.02	77.38	79.17	80	80.82	81.47
2	Sample (Methanol)	47.1176	54.5882	58.7941	63.2941	66.9118	69.7353

BLANK : 0.000; CONTROL : 3.400

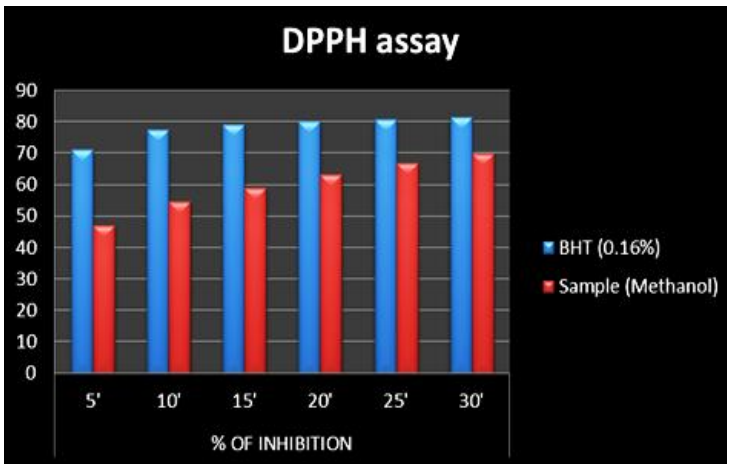

FIGURE 2: ANTIOXIDANT ACTIVITY: ABSORBANCE OF FREE RADICAL FROM DPPH AT 517nm

This antioxidant potential of *Cyperusrotundus*could be attributed to the presence of flavonoids, alkaloids, betacyanins, quinones, terpenoids, and phenols. This could be the reason for its use as a natural immune modulator.

CONCLUSION: The roots and rhizomes of *Cyperusrotundus* are are generally used or their astringent, diaphoretic, diuretic, analgesic, antispasmodic, aromatic, carminative, antitussive, emmenagogue, litholytic, sedative, stomachic, vermifuge, and antibacterial properties.

These findings enrich our knowledge of the chemical constituents that are responsible for the medicinal uses of the plant and the antioxidant potential of *C. rotundus* L.

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