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A concise analysis of pharmacognostic uniformity parameters for priceless plant *Cyperus rotundus*

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Abstract

The pharmacognostic standardization of natural products is a crucial stage in describing the product's quality. The present investigation presents pharmacognostic standards of dried roots of *Cyperus rotundus*. Utilizing standardized techniques, a number of pharmacognostic standards were produced, including ash values, extractive values, moisture content, foreign organic matter, swelling index, foaming index, tannin determination, and volatile oil content. Major bioactive components, including flavonoids, phenolic compounds, tannins, alkaloids, and triterpenoids, were detected in plant extracts using phytochemical screening. Remarkably, coumarin was detected in the methanol extract.Its existence was confirmed by measuring the total phenol and total flavonoids content. Using an optimized solvent system, the fingerprint profile of ethyl acetate and methanol extracts revealed four and two spots, respectively, in thin layer chromatography. To conclude, the selected plant was perfect and suitable for further in vitro as well as in vivo studies to introduce a good herbal product in herbal drug industry.

Keywords: *Cyperus rotundus*; Pharmacognostic standardization; Chromatography; Flavonoids; Coumarin

1. Introduction

Medicinal plants are the potential source of various secondary metabolites. These metabolites are important for the existence of plants as they protect the plants from fungi, bacteria, animals and even other plants. Many modern medicines are derived indirectly from medicinal plants [1]. About 25% drugs in modern inventories are derived from plants, while many others are synthetic analogues built on prototype compounds which ultimately isolated from plants [2,3,4]. About 80% of the world's population uses herbal medicines, mostly for basic medical care, and this percentage is highest in developing nations. They have proven to be effective, safe, culturally acceptable, and less calorie-dense than competing products [5]. Cyperus is one of the most promising genera of the Cyperaceae family, comprising ≈950 species, with *Cyperus rotundus* L. being the most reported species in pharmacological studies [6,7,8]. In Asian countries, the rhizomes of *C. rotundus*, which are used as traditional folk medicines for the treatment of stomach and bowel disorders, and inflammatory diseases, have been widely, investigated [9]. Its tuber part has long been used to treat spasms, diarrhea, dysmenorrhea, and monthly abnormalities as a natural medicine. *C. rotundus* leaves were widely utilized as a flavoring ingredient in Asian cuisine. Pickles, curries, and a variety of baked items still contain its seeds [8]. Polyphenols, flavonoids and simple phenols present in the tubers of *C. rotundus* are well known for their free radical scavenging properties [10].

Moreover, the roots of this promising plant have not been fully investigated. A comprehensive review of the literature found that the majority of research pertaining to pharmacognostic criteria has been conducted on various parts of *C. rotundus*. However, no research on pharmacognostic standardization has ever been done on roots of this plant. The

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current investigation was conducted in part because pharmacognostic standards for authentication are not readily available.

2. Material and methods

2.1. Procurement of plant material

Roots of *Cyperus rotundus* (Nagarmotha) were procured from Majith Mandi, Amritsar, and Punjab. The identity of the plant was confirmed by Dr. Avneet Pal Singh, Assistant Professor, Department of Botany, Punjabi University, and Patiala, India (SPL/Bot- 122; dated 21/09/2021).

2.2. Pharmacognostic standards

The standard methods were followed to generate physico-chemical parameters, including volatile oil content, moisture content, and foreign organic matter, swelling index, extractive values (petroleum ether soluble, alcohol soluble, & water soluble), total ash, acid insoluble ash and water soluble ash [11,12,13,14]. Standard techniques were followed for making a variety of extracts from dried plant material, including n-hexane, ethyl acetate, methanol, and water extracts [15]. The methanol and ethyl acetate dry extracts were dissolved in 3 ml of each solvent and added to volumetric flasks to make a total volume of 5 ml. [16] CAMAG LINOMAT 5 was used to load 10 µl of each extract's stock solution onto TLC plates. By spraying 1% vanilline in concentrated H2SO4 and heating for a few seconds at 100 degrees in a hot air oven, the thin layer chromatograms were made visible. [17] The chemicals, solvents and reagents used in present study were procured from E Merck Ltd., S.D. Fine Chemicals, Mumbai, India, Central Drug House Pvt. Ltd., Mumbai, India, Loba Chemie Pvt. Ltd., Mumbai, India, Sigma, St. Louis, USA.

3. Results

The results obtained for various pharmacognostic specifications for *C. rotundus* displays in table no. 1. The percentage yields of n-hexane, ethyl acetate, methanol and water extracts of *C. rotundus* were found to be 1.63, 3.28, 10.58 and 8.01% w/w respectively. Various extracts of *C. rotundus* were dissolved in their respective solvents and screened for different classes of phytoconstituents using specific standard reagents. The results of phytochemical screening showed presence of only lipids in n-hexane extract. Therefore, this extract was not used for further investigation. Ethyl acetate, methanol and water extracts of plant showed presence of major bioactive compounds such as flavonoids, phenolic compounds, tannins, alkaloids and triterpenoids. Interestingly methanol extract showed presence of coumarin. The fingerprint profiles of the ethyl acetate and methanol extracts obtained by thin layer chromatography display four and two spots, respectively, as indicated in table 2 and figure 1.

Table 1 Mean values of various physicochemical parameters of *C. rotundus*

Sr. No	Pharmacognostic Parameters	Mean ± S.D(%W/W)
1	Moisture content*	9.36 ±0.333
2	Total ash**	16.17 ±0.161
3	Acid insoluble ash**	7.75 ±0.862
4	Water soluble ash**	8.93 ±0.911
5	Alcohol soluble extractive value**	11.55 ±0.945
6	Water soluble extractive value**	9.87 ±1.674
7	Foreign organic matter*	Nil
8	Crude fiber content*	14.9 ±2.487
9	Swelling index*	Nil
10	Volatile oil*	2.26%V/W

n=3; *air dried weight basis, ** dry weight basis

Table 2 Results of thin layer chromatography (Extracts of *C. rotundus*)

Extract	Mobile phase	No. of spots
Ethyl acetate	Toluene: Ethyl acetate: Glacial acetic acid (15:11:2)	Four spots at R_f Value 0.46, 0.66, 0.68, 0.74
Methanol	Toluene: Ethyl acetate: Glacial acetic acid (15:11:2)	Two spots at R_f Value 0.44, 0.66

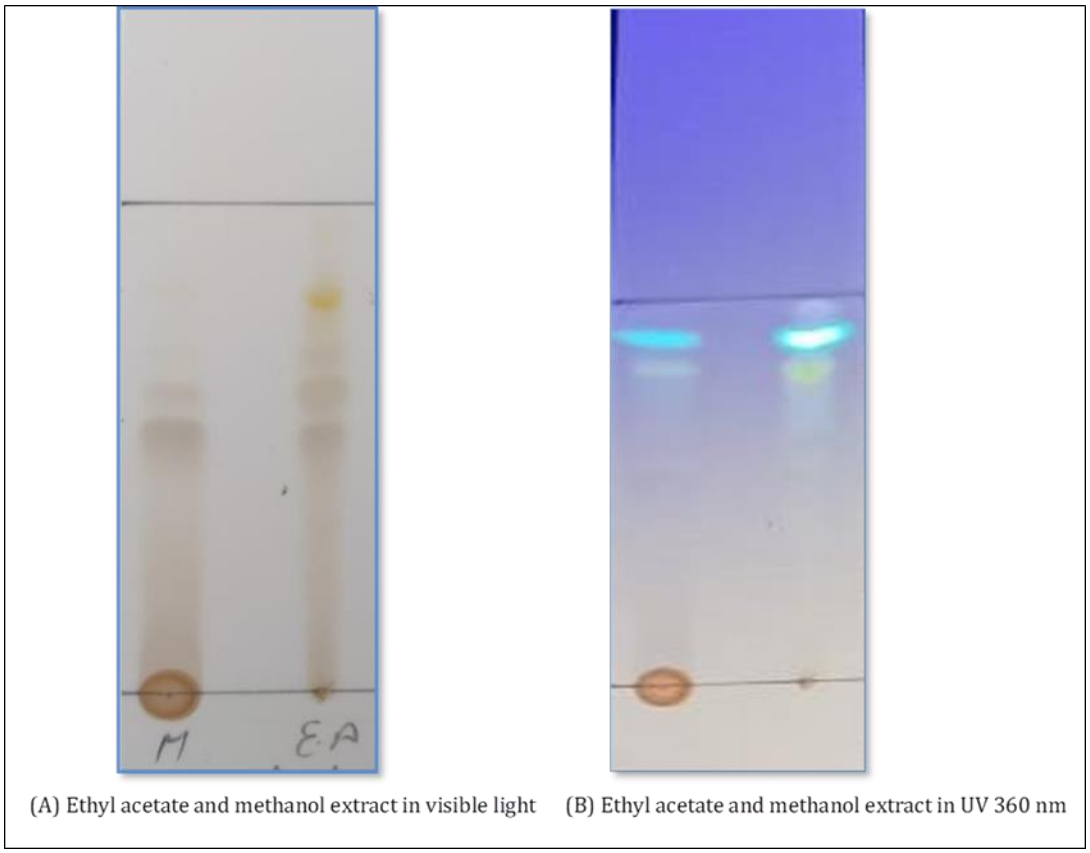

Figure 1 Fingerprint profiles of the ethyl acetate and methanol extracts obtained by thin layer chromatography

Before using it as raw material for study, authentication is a crucial prerequisite. Therefore, the establishment of pharmacognostic standards was aimed at verifies the authenticity of the plant materials roots (*C. rotundus*). The natural product researcher can choose genuine plant material for phytochemical and pharmacological study with the use of these pharmacognostic standards

4. Conclusion

In summary, our focused exploration of pharmacognostic parameters in *Cyperus rotundus* sheds light on the unique botanical profile and therapeutic potential of this medicinal herb. Through meticulous analysis of morphological, microscopic, and chemical characteristics, we have unveiled key insights into the plant's identity and quality. The elucidation of pharmacognostic parameters in *Cyperus rotundus* not only enriches our understanding of its pharmacological attributes but also provides a foundation for ensuring consistency and authenticity in herbal formulations. This study contributes valuable knowledge to the utilization and standardization of *Cyperus rotundus*, paving the way for its informed and effective integration into traditional and modern healthcare practices. Researcher investigating natural products may utilize the current study's findings as an outline for verifying for further phytochemical and pharmacological research.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

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