

FROM TRADITIONAL KNOWLEDGE TO MODERN MEDICINE: *CYPERUS SCARIOSUS* AND ITS MULTIFACETED PHARMACOLOGICAL PROPERTIES

Abstract

Due to their vast store of organic natural components, medicinal and aromatic plants like *Cyperus scariosus* play a significant role in both traditional and modern medicine. In poor nations where traditional medical practises are still relevant, these herbs are highly appreciated. The negligible side effects of medicinal plants, in contrast to manufactured drugs, make them helpful for treating a variety of illnesses. The Cyperaceae family includes *Cyperus scariosus*, sometimes referred to as Nut grass or Nagarmotha, which is well renowned for its medicinal properties. An vital component in Ayurvedic formulations, the plant's essential oil is extracted from the rhizomes and roots of the plant and has anti-inflammatory, antibacterial, and antifungal qualities. Its roots have a lengthy history of usage in medicine, where they have been used as a diaphoretic, tonic, and therapy for ailments including seizures and spasm a high temperature, and harm to the liver. Because of its antibacterial, antifungal, and growth-regulating qualities, the essential oil of the plant is used for more than just perfumery. Additionally, it has potential for uses in analgesia, diabetes prevention, and hepatoprotection. Slender leaves, a July flowering and December fruiting period, and a fruit bearing season define *C. scariosus*. It has been shown to have anti-nociceptive characteristics, hypotensive and spasmolytic effects, hepatoprotective qualities, and antidepressant potential. The plant extract has also demonstrated hypoglycemic and hypolipidemic properties, making it advantageous for controlling hyperlipidemia and diabetes. Additionally, its antibacterial,

Authors

Versha Parcha

Department of Pharmaceutical
Chemistry and Chemistry
Dolphin PG institute of Biomedical and
Natural Sciences
Manduwala Dehradun
vershaparcha@gmail.com

Pankaj Bhandri

Department of Pharmaceutical
Chemistry and Chemistry
Dolphin PG institute of Biomedical and
Natural Sciences
Manduwala Dehradun

Ajay Rana

Department of Pharmaceutical
Chemistry and Chemistry
Dolphin PG institute of Biomedical and
Natural Sciences
Manduwala Dehradun

Shivani Kashyap

Department of Pharmaceutical
Chemistry and Chemistry
Dolphin PG institute of Biomedical and
Natural Sciences
Manduwala Dehradun

antifungal, and antioxidant properties add to its therapeutic profile.

A thorough study of the plant's botany, traditional usage, phytoconstituents, therapeutic benefits, and clinical applications is still lacking, despite the fact that there has been much research on the chemical components and pharmacological properties of the plant. By providing information on *C. scariosus* and discussing its phytochemical investigations, pharmacological potentials, toxicity issues, and possibilities for further study, this paper seeks to close the knowledge gap.

Keywords: Cyperus scariosus, Pharmacological properties, Traditional knowledge, Medicine

I. INTRODUCTION

Both conventional and contemporary medicine depend heavily on medicinal and aromatic plants, which provide a great reservoir of organic natural products. In many developing countries, traditional medicinal practices, which are considered alternative systems of healthcare, continue to fulfill essential health requirements. Unlike synthetic chemicals, medicinal plants are preferred due to their minimal adverse effects, making them valuable for treating a spectrum of ailments (Khan et al., 2009) [25].

The world of natural products offers a huge variety of chemical structures that serve as building blocks for molecules that may be improved by chemical processing or de novo synthesis to improve their functions. (Houghton, 1995) [19]. Within this spectrum, chemical substances with physiological activity such as broad herbal extracts and essential oils stand out as prospective disease-controlling treatments that provide safety benefits over traditional remedies. (Tripathi and Dubey, 2004) [45].

The Cyperaceae family has several aromatic and therapeutic plants that include notable chemical compounds with biological functions. *Cyperus scariosus*, a versatile medicinal herb belonging to the extensive monocotyledonous According to Schultze-Motel (1964), the Cyperaceae family has over 3700 species in 70 genera [44]. Numerous names, including Nut grass, Nagarmotha in Hindi, Nagar musta in Sanskrit, Lawala in Marathi, Koraikkilangu in Tamil, and xiangfu/xiangfuzi in Chinese, are given to the perennial, thin sedge *C. scariosus* (Chopra et al., 1986) [8]. It may be found all across the nation, frequently along waterfalls and rivers.

Characterized by its delicate appearance and reaching heights of 45-75 cm, *C. scariosus* boasts sharp, pointed leaves measuring 0.3-0.85 cm in width. Blossoming in July and bearing fruits in December, its flowers can grow from 5 to 17.5 cm in length. This plant thrives in sunny, wet environments and does well on sandy and loamy soils, favouring Pacific Islands and coastal areas in particular.. With rapid growth, it forms an intricate network of roots and rhizomes that penetrate the soil up to 3-4 cm deep, releasing a pleasant aromatic fragrance.

Numerous Ayurvedic compositions include aromatic material from the root systems and roots of *C. scariosus*, which is well known for its anti-inflammatory, antibacterial, and antifungal effects. Folk traditions attribute the roots with a range of attributes, from being a cordial, tonic, and diaphoretic to aiding in addressing conditions such as epilepsy, fever, and liver damage (Said, 1982) [43]. Moreover, this plant finds application in fodder, while its tuberous root system are utilized for culinary, medicinal, and fragrance manufacturing purposes. It plays a role in treating diverse ailments including diarrhea, epilepsy, gonorrhea, liver damage, and syphilis, forming a significant component of indigenous medicinal recipes (Kritikar and Basu, 1918) [27].

In addition to having value in aromatherapy(Kahol et al., 1987) [21], extracted essential oil from the rhizomes and roots also has inhibition effect against bacterial strains (Lahariya and Rao, 1979) [29], antifungal (Deshmukh et al., 1986) [10], and plant growth-regulating (Kalsi et al., 1980) [24] qualities. Additionally, this oil has promise for analgesic and anti-diabetic effects (Alam et al., 2011). [2], [16], [16] hepatoprotective effects,

hypotensive results, and spasmolytic activities.

This chapter seeks to bridge this gap by presenting current insights into the plant's phytochemical explorations, pharmacological potentials, toxicity considerations, and prospective avenues for research.

II. TAXONOMY, DISTRIBUTION AND MORPHOLOGY

This plant is a member of the Order Poales, Family Cyperaceae, Genus *Cyperus*, and Species *scariosus* of the Kingdom Plantae. Pantropical and warm temperate zones are home to the *Cyperus* genus. *Cyperus scariosus* is a common plant in India, especially in the states of Chhattisgarh, Bihar, Orissa, moist regions of Uttar Pradesh, Madhya Pradesh, and Bengal. Additionally, it may be found in the Pacific Islands, China, and South Africa.

Initially white, the plant eventually turns brown or black and emits a muddy odor. Stolons, measuring 10-20 cm in length, are densely packed with rhizomes that are bluntly conical and vary in size and thickness. These rhizomes are fleshy and white with scaly leaves when young, but become fibrous and wiry as they age.

Cross-sections of these rhizomes reveal distinct features. The outer layer comprises small tabular cells forming the epidermis, followed by a hypodermal sclerenchyma composed of 3-4 layers packed with brownish or blackish tannin deposits. A wide inner cortex zone contains parenchyma cells filled with elliptical starch grains measuring 12-15 μm wide at the broadest region and 4-6 μm at the narrowest. Many of these parenchyma cells also contain condensed natural reddish-brown material, consisting of a blend of terpenoids and alkaloids.

Lignified, tangentially elongated cells of a two-layered fake endodermis that contains the innermost cortex and the stele divide the two. Vascular fibres that are dispersed throughout the stele and ground parenchyma tissue that resembles cortical parenchyma make up its physical composition. Phloem is located at the centre of each concentric vascular thread, which is bordered by xylem. While an alkaloid-terpenoid complex is seldom seen in phloem cells, some of them do contain tannins (Adams et al. 2013).

The essential oil derived from *C. scariosus* primarily consists of sesquiterpenes, with prominent constituents including cyperene, rotundene, rotundenol, isopatchoula-3,5-diene, isopatchoul-3-ene, β -selinene, isopatchoulenol, and scariodione. Phytochemical investigations reveal that this plant is rich in various secondary metabolites, including polyphenols, flavonols, glycosides, alkaloids, saponins, and sesquiterpenoids. The extraction of essential oil from *C. scariosus* rhizomes is typically accomplished through steam distillation. In this procedure, dried and crushed rhizomes are passed via steam produced by a boiler. The pressure of the steam is carefully regulated based on the specific characteristics of the plant material. The equipment used for this distillation process, which consists of the storage tank, condensing device and receiver-cum-separator, is composed of stainless steel to maintain sanitary and quality standards. (Sahu et al. 2010).

Industrial oil from the rhizomes of *C. scariosus* is known as cyperiol. This oil is obtained through the hydro-distillation method, which involves the extraction of essential oil

using water as a solvent. This oil is appreciated for its variety of secondary metabolites contributing to its potential uses in various applications.

III. PHYTOCHEMICAL CHARACTERISTICS

As compared to *C. rotundus*, little information is available on the chemical composition of *C. scariosus*. The essential oil was found to contain bicyclic and tricyclic sesquiterpenes (Naves and Ardizio 1954)^[31]. Dhingra and Dhingra (1957)^[11] reported that the essential oil of *C. scariosus* contains a bicyclic ketone, a tricyclic tertiary alcohol and a tricyclic sesquiterpene hydrocarbon. Nerali *et al.* (1965)^[35] reported the isolation of a new sesquiterpene ketone isopatchoulone

(I) Which was structurally similar to patchoulone from *C. scariosus*. Nigam (1965)^[37] isolated a sesquiterpene ketone, cyperenone from the same species. Hikino *et al.* (1967)^[18] isolated a sesquiterpene ketone cyperotundone from the three species of the *Cyperus* genus (*C. rotundus*, *C. scariosus* and *C. articulatus*). Neville *et al.* (1968)^[36] isolated a ketone and from spectral data established that the ketones isolated by the earlier investigators were one and the same and proposed a new name, isopatchoul-4 (5)-en-3-one (I). Nerali *et al.* (1967)^[33] isolated two sesquiterpene alcohols, cyperenol (II) and patchoulenol from the alcoholic fractions of the essential oils of the tubers. Nerali and Chakravarti (1969)^[32] established the structure and stereochemistry of scariodione, from the oil of *Cyperus scariosus* Nerali *et al.* (1970)^[34] isolated rotundene and rotundenol sesquiterpenes from *C. scariosus* and the structure was established by Paknikar *et al.* (1977)^[38]. Two sesquiterpenoid hydrocarbon (-)-beta-selinene and the new compound isopatchoula-3,5-diene (VII) was isolated from the essential oil of *C. scariosus* rhizome (Gopichand *et al.* 1978)^[17]. Uppal *et al.* (1984)^[46] isolated a new hydrocarbon, isopatchoul-3-ene which on spectral characterization was found to be a tricyclic compound with an isopatchoulane type carbon skeleton. Longiverbenone, a naturally occurring sesquiterpene was isolated from ethanolic extract of *C. scariosus* rhizome by solvent-solvent partitioning and chromatographic technique (Rahman and Anwar 2008)^[40]. Sahu *et al.* (2010)^[46] isolated a new compound, 2, 3- diacetoxy-19-hydroxy-urs-12-ene-24-O-β-D-xylopyranoside from tubers of *C. scariosus*. The preliminary phytochemical investigation of hexane and chloroform extracts of *C. scariosus* rhizomes chromatographed on silica gel led to the isolation of stigmaterol, β-sitosterol and lupeol as major constituents (Kakarla *et al.* 2015)^[22]. Bhatt *et al.* (1981)^[4] studied the phytoconstituents of the leaves of *C. scariosus* and isolated a phenolic glycoside, which on acidic hydrolysis gave an aglycone along with glucose and rhamnose. The aglycone was identified as leptosidin and the structure of the new glycoside was assigned as leptosidin 6-O-β-D-glucopyranosyl-O-α-L-rhamnopyranoside. Two glycosides, leptosidin-6-O-[β-D-xylopyranosyl (14)-β-D-arabinoside (Bhatt *et al.* 1984)^[6] and stigmasta-5, 24 (28)-diene-3 β-O-α-L-rhamnopyranosyl-O-β-D-arabinopyranoside were also isolated from the leaves (Bhatt *et al.* 1982)^[5].

Table 1: Major Compounds

Sr. no.	Major compounds	Percentage	Reference
1	Isopatchoul-4(5)-en-3-one	16.5	Garg <i>et al</i> 1990 ^[14]
	Cyperene	15.75	
	Patchoulone	7.60	
	Rotundone	5.10	
	Rotundene	4.75	
	An unidentified sesquiterpenoid	7.20	
2	Cyperene	13.91	Pandey and Chowdhury 2002 ^[39]
	Caryophyllene oxide	12.45	
	Iso-patchoul-4 (5)-en-3-one	12.25	
	Trans-pinocarveol	7.24	
	Rotundene	5.76	
	Eudesma-4(14)-11-diene	4.55	
	Rotundone	4.32	
	α -gurjunene	3.53	
Guaiazulene	3.21		
3	Camphene	11.26	Chowdhury <i>et al</i> 2005 ^[9]
	α -pinene	8.84	
	Copaene	7.6	
	caryophyllene oxide	7.15	
	Myrtenal	6.41	
4	Cyperene	30.60	Dubey <i>et al</i> 2011 [12]
	α -Humulene	10.66	
	Valencene	6.18	
	β -caryophyllene oxide	3.84	
	Longifolendehyde	4.11	
	Zierone	6.54	
5	Cyperene	19.84	Dubey <i>et al</i> 2011 [12]
	α -Humulene	7.12	
	Valencene	5.43	
	β -caryophyllene oxide	3.73	
	Longifolendehyde	4.59	
	longiverbenone	5.89	
	Zierone	10.68	

IV. PHARMACOLOGICAL ACTIVITIES

According to studies and reports by several researchers, *Cyperus* contains a variety of chemical components, including mainly sesquiterpenoids, the majority of which may have pharmacological effect.

- 1. Anti-Nociceptive Activity:** A methanol extract of *C. scariosus* leaves' anti-nociceptive properties was studied by Alam et al. in 2011 [2]. Five groups of seven mice each were created by dividing the animals. Group I acted as the control group (10 mg/kg body weight, 1% Tween 80 in water). Group-II mice received aspirin at a dosage of 200 mg/kg body weight. Groups III to V received 50, 100, and 200 mg/kg of the extract orally, respectively, 30 minutes before to receiving an injection of acetic acid. Pain was generated in all groups by injecting 10 ml/kg of body weight of 1% acetic acid intraperitoneally. Each animal was given a 5 minute interval, after which the number of writhings was tallied for 10 minutes. The highest writhing inhibition with leaf methanol extract was reported to be reached at a dosage of 200 mg extract/kg body weight (p0.01), whereas the conventional aspirin induced a writhing inhibition of 56.74% (p0.001) at the same dose.
- 2. Hypotensive and Spasmolytic Activity:** A hydro-methanolic extract of *Cyperus scariosus* led to hypotensive and bradycardic effects when administered intravenously. These results persisted in atropinized rats, showing that muscarinic receptor activation is not a mediator of the plant extract's cardiovascular effects. In vitro tests on rat uterus, rabbit jejunum, and guinea-pig paired atria revealed that it reduced spontaneous contractions in a concentration-dependent (0.1–1 mg/ml) manner. Additionally, it prevented guinea pig ileal contractions brought on by histamine or acetylcholine, showing a general spasmolytic effect. It reduced contractions elicited by norepinephrine (10 pM) and K⁺ (80 mM) at comparable doses (0.1–1 mg/ml) in the rabbit aorta. These findings suggest that Ca²⁺ channel blocker-like constituents may be present in *Cyperus scariosus*, which may account for the hypotensive effect shown in vivo. and the general spasmolytic activity of plant may explain its folkloric use in diarrhea (Gilani *et al.* 1994) [15].
- 3. Hepatoprotective Activity:** We looked at the hepatoprotective properties of *Cyperus scariosus*' aqueous-methanolic extract against acetaminophen and CCl₄'s ability to cause liver damage. Acetaminophen therapy in mice resulted in complete mortality at a dosage of 1 g/kg, whereas pretreatment with a plant extract (500 mg/kg) decreased the death rate to 30% of animals. A dosage of 640 mg/kg of paracetamol caused an increase in the blood levels of the enzymes alkaline phosphatase, glutamate oxaloacetate transaminase, and glutamate pyruvate transaminase as well as liver damage in rats. Rats pretreated with plant extract (500 mg/kg) had substantially decreased blood levels of ALP, GOT, and GPT (P 0.05). A same amount of plant extract (500 mg/kg) significantly reduced (P 0.05) serum enzymes caused by CCl₄ to increase and also stopped CCl₄'s extension of pentobarbital sleeping time (Gilani and Janbaz 1995)^[16].
- 4. Hypersensitivity:** *C. scariosus* chloroform fraction significantly inhibits T cell responses in Balb/c mice in both humoral and When cyclosporine-A, a common T cell inhibitor,

was given to Balb/c mice a response was observed in both humoral and When cyclosporine-A, a common T cell inhibitor, was given to Balb/c mice a response was observed in both humoral and When cyclosporine-A, a common T cell inhibitor, was Bhagwat et al. (2009) found that *C. scariosus* did not significantly ($p < 0.01$) reduce the Th2 (IL-4) system. [3].

- 5. Antidepressant Activity:** In mice, *C. scariosus* oil's n-hexane extract showed antidepressant properties. Using the forced swim test and the tail suspension test on mice, antidepressant activity was assessed at two dose levels of 100 and 200 mg/kg, and the results were compared to those of the reference medication, imipramine, at 15 mg/kg.

Similar to the medication imipramine, *C. scariosus* n-hexane extract oil considerably ($p < 0.001$) decreased the immobility period at both dosage levels at FST and TST. Due to an increase in the concentration of norepinephrine in synapses, the n-hexane extract of *C. scariosus* oil may exhibit antidepressant effect (Ramesh et al. 2012) [41].

- 6. Micro Propagation:** For in vitro regeneration, *C. scariosus* axillary bud explants were inoculated on SH media and supplemented with various amounts of Benzyl adenine, Kinetin, and Indole-3-butyric acid. After two weeks of culture inoculation, the greatest number of shoots were seen on media containing 1.0 mg/lit BA and 1.0 mg/lit Kn. The best outcomes were obtained when Kn 1 mg/lit was combined with Adenosine 1 mg/lit and Charcoal 500 mg/lit [44]. On SH medium with Kn 0.75 mg/lit+ADS 1.0 mg/lit+activated charcoal 500 mg/lit, efficient flowering of 80% was observed. On full strength SH medium supplemented with Kn1.5mg/lit+ADS1.0mg/lit+ activated charcoal 500mg/lit+5% coconut water, multiple shooting and multiple rooting were successful (Lavanya et al. 2005). [30].
- 7. Hyperglycemic Inhibition:** On mice, the ability of *C. scariosus* leaves to increase glucose tolerance was examined. Each of the six groups contained seven starved mice. The control group, Group I, got 10 ml/kg of 1% Tween 80 in water, 10 mg/kg of glibenclamide, and four different dosages of the methanol extract of *C. scariosus* leaves. Group II received the usual medicine, glibenclamide, in these amounts. All mice received an oral glucose dosage of 2 g/kg body weight after an hour, and blood samples were taken two hours after the glucose was given to the animals. The glucose oxidase technique was used to measure serum glucose levels. The results demonstrated that the activity of the methanol extract was dose-dependent. As compared to the control, the extract's dosage increase had a noticeable impact. The highest level of inhibition was seen at a dosage of 400 mg extract/kg body weight (46.86%), which was nearly as effective as the commonly prescribed medication glibenclamide (57.62%) at a dose of 10 mg/kg body weight. (2011) (Alam et al.) [2].
- 8. Hypolipidemic Activity:** Chawda et al. (2014) [7] examined the lipid-lowering and antioxidant effects of a hydroalcoholic extract of *Cyperus scariosus* Linn. root (HCS) in guinea pigs given a high cholesterol diet. *Cyperus scariosus* hydroalcoholic extract reduced serum lipid profiles and atherogenic indices in all dosages ($P < 0.05$). Rosuvastatin raised serum AST and ALP levels while the greater dose of hydroalcoholic extract decreased serum AST, ALP, and LDH levels ($P < 0.05$). On the liver histology of treated animals, there was a decrease in lipid buildup and an improvement in the hepatocytes,

which may be related to the antioxidant activity of the extract that contained phenolic compounds.

- 9. Antioxidant Activity:** The scavenging of DPPH•, ABTS•+, NO, •OH, O₂•-, and ONOO- by the 50% methanolic extracts of *C. scariosus* from various plant sections revealed the presence of considerable levels of polyphenols with exceptional antioxidant activity. It demonstrated substantial potential for scavenging free radicals and reducing oxidative DNA damage. The extracts exhibited very high levels of total phenolic content and total flavonoid content, both of which support their antioxidant effects, according to Kalim et al. (2010) [23]. Examine the ability of a 50% ethanol extract of *C. scariosus* to suppress T cells.
- 10. Antifungal activity:** Six dermatophytes (*Keratinomyces ajelloi*, *Microsporum gypseum*, *Trichophyton equinum*, *T. mentagrophytes*, *T. rubrum*, and *T. terrestre*) were examined for their antifungal capabilities using essential oils from the leaves of 14 different plants. While oils from *Murraya koenigii*, *Thuj aorientalis*, *Mimusops elengi*, and *Cymbopogon martini* var. *motia* were active against certain fungi, essential oil from *Cyperus scariosus* had strong activity against all dermatophytes (Deshmukh et al. 1986) [10]. The antifungal activity of fresh and distilled *C. scariosus* rhizomes from Uttar Pradesh (India) and Madhya Pradesh (India) was tested by Dubey et al. (2011) [12] against the phyto-pathogenic fungus *Rhizoctonia solani*. Fresh rhizomes from the U.P. and M.P. had the highest fungitoxicity, with ED₅₀ values of 448 and 478 g/ml, respectively. Steam-distilled oil from these two states had ED₅₀ values of 512 and 517 g/ml, respectively. The oil made from distilled rhizomes had the least amount of activity, with an ED₅₀ of 1007 g/ml for up oil and 1032 g/ml for M.P oil.
- 11. Antibacterial Activity:** Longiverbenone, a naturally occurring sesquiterpene, was isolated from an ethanolic extract of *Cyperus scariosus* rhizome utilising a solvent-solvent portioning and chromatographic method. The antibacterial activity of longiverbenone was tested using the disc diffusion method against eleven potential human pathogenic pathogens. The minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were estimated using the broth macrodilution method (Rahman and Anwar 2008) [40].
- 12. Cytotoxic Activity:** The cytotoxic action of longiverbenone (lethal concentration 50%, LC₅₀) was assessed in newly birthed brine prawns (*Artemia salina*). Here, it demonstrated moderate to good antibacterial effectiveness against the test pathogens. In tests against *Vibrio cholerae*, it has the lowest MIC (20 g/ml) and MBC (80 g/ml). According to Rahman and Anwar (2008), the isolated sesquiterpene's LC₅₀ value for new-born brine prawns was 14.38 g/ml. [40]¹.
- 13. Larvicidal and Ovicidal Activity:** Elumalai et al. (2010) [13] studied the larvicidal and ovicidal activities of *Cyperus scariosus* essential oil against the fourth-instar larvae of *S. litura*. After 24 hours of exposure, the essential oil had a somewhat harmful impact on the lepidopteran armyworm pest. The shoot of *C. Scariosus* exhibited good larvicidal activity and a moderate ovicidal action (LC₅₀ = 27.3, 29, 30.6, 31.2, LC₉₅ = 43.6, 48.2, and 56 ppm).

V. ACUTE TOXICITY STUDY

An acute toxicity test was performed by Alam et al. (2011) [2]. The entire number of animals was divided into nine groups, each consisting of six creatures. A dosage of 2 ml/kg body weight of 1% Tween 80 in ordinary saline was administered to the control group. The remaining groups received dosages of 100, 200, 300, 600, 800, 1000, 2000, and 3000 mg/kg of the leaf extract in methanol. The animals were meticulously examined to see whether any mortality occurred over the next eight hours and for up to 14 days. No mortality was recorded after the 14-day observation period with any of the extract doses. No mortality was recorded after the 14-day observation period with any of the extract doses. With albino rats, another study on acute toxicity was conducted. Rats that had been fasted overnight were given various ratios of essential oils at 5000.

VI. PHYTOTOXICITY ACTIVITY

The toxicological effects of the *C. scariosus* plant on maize (*Zea mays*) seeds were investigated by Khan et al. (2015) [26]. As compared to control, the *C. scariosus* methanolic extract demonstrated the least amount of stalk development and the most amount of root and stalk inhibition at 3 mg/ml. The sequence in which each. The stalk and root development of the *C. scariosus* plant can be described as follows after 5 and 10 days: 1.5 mg/ml, 0.75 mg/ml, 0.37 mg/ml, 3. In contrast to other curative plants, maize (*Zea mays*) plant roots and shoot germination were hindered by the methanolic extract, but not to a substantial extent.

VII. CONCLUSION

Cyperus scariosus, commonly known as *C. scariosus*, holds a prominent place in Indian Ayurvedic medicine, revered for its diverse pharmacological and traditional applications. This plant has garnered attention for its ethnomedical heritage, therapeutic properties, and pharmacological potential, leading to the development of nutraceuticals and pharmaceutical products aimed at combating various ailments. Particularly noteworthy are the volatile oils, flavonoids, phenolic acids, coumarins, steroids, and iridoid glycosides that make up the rhizomes and tubers of *C. scariosus*. Among these, the volatile essential oils, primarily composed of sesquiterpenoids, stand out as a significant component.

Hitherto, research on this plant species has concentrated on extract characterization, identification, and exploring the biological attributes of its extracts and essential oils. However, there exists a distinct need for more comprehensive investigations into the intricate chemical compounds present within these extracts and essential oils. Such studies hold the potential to unravel the precise metabolites responsible for the observed activities, thereby deepening our understanding of the plant's therapeutic potential.

In summation, the abundance of diverse phytochemicals within *C. scariosus* underpins its immense promise for integration into the pharmaceutical industry. This plant's multifaceted nature, coupled with its historical significance in traditional medicine systems, underscores its role as a source of valuable compounds that could contribute to the development of innovative pharmaceutical products.

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