

Medicinally & Pharmacologically

IMPORTANT GRASS SPECIES OF INDIA

Bhagwati Prashad Sharma

Maheswari Behera

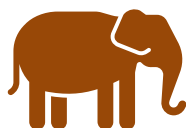
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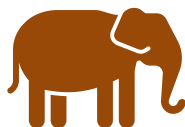
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Grasses are the tresses of mother earth.

Bhagwati Prashad Sharma

Grasses- the green magic of nature.

Maheswari Behera

*The strength of the land begins with the
softness of grass.*

Debangshu Agrahari

*Grass whispers the strength of life: humble,
persistent, and endlessly renewing.*

Sanjeet Kumar



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PREFACE

Grasses, belonging to the family *Poaceae*, are among the most ecologically dominant and economically significant plant groups on Earth. They not only sustain global food systems but also harbour immense medicinal, pharmacological, and ecological potential. Despite their ubiquity and vital role in ecosystem balance, grasses have often been underexplored in terms of their phytochemical composition and therapeutic applications. Recognizing this research gap, the present volume titled “*Medicinally & Pharmacologically Important Grass Species of India*” brings together a collection of scientific studies that highlight the biochemical, pharmacological, and antioxidant profiles of diverse grass species found across India. This book compiles original research contributions from several botanists, phytochemists, and ecologists who have systematically analyzed the phytoconstituents and biological activities of key grass taxa. Each chapter focuses on a specific species, unravelling its phytochemical profile, antioxidant potential, and ecological significance. The opening chapter presents a detailed phytochemical profiling and chromatographic characterization of *Panicum repens* L., followed by studies on *Ottochloa nodosa*, *Bothriochloa pertusa*, and *Saccharum spontaneum* that explore their antioxidant and pharmacological potentials from ecological and biochemical perspectives. Subsequent contributions examine species such as *Leersia hexandra*, *Alloteropsis cimicina*, and *Eragrostis ciliaris*, each demonstrating promising antioxidant and nutraceutical properties. The final chapters extend the exploration to *Digitaria longiflora*, *Polytrias indica*, *Rottboellia cochinchinensis*, and *Sporobolus diandrus*, providing comprehensive insights into their bioactive compounds and potential applications in herbal medicine and sustainable health systems. This compendium serves as a scientific reference for researchers, academicians, and conservationists. It also aims to inspire future investigations into the phytopharmacological potential of lesser-known grass species. The editors express their sincere gratitude to all contributing authors for their valuable research inputs and to the Ambika Prasad Research Foundation (APRF), Odisha, India, for fostering a multidisciplinary platform dedicated to biodiversity documentation and conservation-based innovation. We hope this book will make a significant contribution to the growing body of literature on medicinal grasses and encourage the scientific community to explore further the hidden pharmacological wealth of India’s grass flora.

Editors

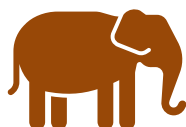
BACKGROUND

Grasses, belonging to the family *Poaceae*, form one of the largest and most widely distributed plant families on Earth, encompassing more than 12,000 species that thrive across diverse ecosystems from wetlands and forests to arid plains and alpine zones. They are the foundation of terrestrial ecosystems, serving as primary producers that support herbivores, livestock, and, ultimately, human life. Grasses produce a wide range of secondary metabolites such as flavonoids, phenolics, alkaloids, terpenoids, saponins, and tannins which contribute to their antioxidant, antimicrobial, anti-inflammatory, and antidiabetic activities. These bioactive compounds play a crucial role in plant defense and ecological adaptation, and many of them have shown promising therapeutic potential in modern pharmacological research. Exploring these properties can lead to the discovery of novel natural drugs, nutraceuticals, and eco-friendly bioproducts. Beyond their medicinal value, grasses are indispensable to the survival of wildlife and livestock. They form the primary component of natural and cultivated pastures, providing high-quality forage for herbivorous animals such as deer, elephants, cattle, sheep, and goats. The presence of phytochemicals also contributes to the health and immunity of grazing animals, enhancing their resistance to diseases and improving productivity. Moreover, grasses contribute significantly to ecological stability and environmental conservation. They prevent soil erosion, improve soil fertility, act as carbon sinks, and aid in habitat restoration. Many species exhibit remarkable resilience to drought, salinity, and nutrient-poor conditions, making them vital components of sustainable ecosystems and climate-resilient landscapes. Despite this immense importance, the grasses of India have received limited scientific attention concerning their phytochemical and pharmacological attributes. Most grasses are still considered weeds or mere fodder, and their potential as sources of natural medicines and bioactive compounds remains largely untapped. Systematic documentation and biochemical characterization of these species are, therefore, essential for understanding their medicinal, ecological, and economic significance. In this context, the present volume "*Medicinally & Pharmacologically Important Grass Species of India*" aims to bridge this research gap by providing comprehensive scientific insights into selected grass species. The book emphasizes not only their phytochemical and pharmacological values but also their ecological roles and importance as fodder resources for wildlife and livestock. This integrated approach highlights the need for conserving grass biodiversity and promoting sustainable utilization of these often-overlooked yet highly valuable plants for both ecological and human welfare.

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Chapter 1

Phytochemical profiling and chromatographic characterization of antioxidant activity of *Panicum repens* L. (Poaceae)

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ABSTRACT

Ecologically significant as a fodder resource, soil stabilizer, and climate-resilient species, *Panicum repens* is widely distributed across moist and disturbed habitats. It not only prevents erosion but also provides forage for livestock and wildlife, highlighting its dual potential. In contemporary situation where global health problems and climate change are major concern. In this aspect, there is a need to screen unexplored plants for evaluation medicinal uses as well as have ecological importance. Therefore, an attempt has been made to screen available secondary metabolites and antioxidant properties of *Panicum repens*. Results revealed the presence of tannins and reducing sugars, while TLC (Thin Layer Chromatography)-based DPPH (2,2-diphenyl-1-picrylhydrazyl) analysis confirmed distinct antioxidant activity. These findings indicated that beyond its ecological role, *P. repens* also possesses bioactive potential, highlighted the need for further pharmacological and nutritional investigations.

Keywords: Antioxidant activity, bioactive potential, fodder resource

INTRODUCTION

Panicum repens, a stoloniferous perennial grass of the Poaceae family, has long adapted to wetlands, riverbanks, and marginal lands, where its vigorous growth contributes significantly to soil stabilization and erosion control (Brecke et al., 2001). Its extensive root system binds the soil effectively, reducing the impact of surface runoff and promoting sediment retention. This ability highlights its role as an ecologically viable species capable of securing disturbed habitats and supporting ecosystem resilience. As a fodder resource, *P. repens* provides a dependable food source for both wildlife and livestock. Its tolerance to varied environmental stresses, such as salinity and drought, make it suitable for sustaining animal populations under fluctuating climatic conditions (Muhammad et al., 2024). Such defense mechanisms can be developed due to presence of diverse secondary metabolites in the parts of *P. repens* (Figure 1) which could be useful to fight current health problems (Fatima et al., 2018). Therefore, in present study, qualitative phytochemical analysis and antioxidant properties were carried out and results are presented in the chapter. The present study gives a base line data regarding its role in wildlife & livestock management alongside draw attention towards its pharmacological potentials (Knez et al., 2023).

METHODOLOGY

Whole plants of *Panicum repens* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by authors followed by published literature (Behera et al., 2025). Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and using Soxhlet method extraction (n-Hexane, Ethanol and Aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was done using standard methods (Jena et al., 2025; Kumar et al., 2013, Pattnaik and Bhatnagar, 2023).



Figure 1: Plant parts of *Panicum repens*

RESULTS AND DISCUSSION

Qualitative phytochemical analysis of *Panicum repens* for detection of secondary metabolites revealed the presence of diverse secondary metabolites (Table 1). Saponins were detected only in the aqueous extract, while flavonoids, terpenoids, phenolic compounds, steroids, alkaloids, and carbonyl compounds were absent in all extracts. This indicated a limited but notable phytochemical profile (Table1; Figure 2-4), with aqueous extract yielding slightly greater metabolite diversity than other solvents. TLC-based DPPH analysis of the aqueous extract displayed antioxidant-active spots under different solvent systems (Table 2; Figure 5). A clear spot with $R_f = 0.984$ was observed in both Ethyl acetate: Methanol: Water (40:5.4:4) and Chloroform: Ethyl acetate: Formic acid (5:4:1), while streaking patterns (R_f range 0.230–0.523 and 0–0.276, respectively) indicated the presence of multiple antioxidant compounds. In the n-Hexane: Petroleum ether: Ethanol (10:10:80) system, no discrete spots were observed, though streaking was detected within the range $R_f = 0.5$ –0.766. These findings suggest that polar solvent systems are more effective in resolving antioxidant constituents in *P. repens*.

Table 1: Qualitative phytochemical analysis of *P. repens*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin and Reducing sugars
	Aqueous	Tannin, Saponin and Reducing sugars

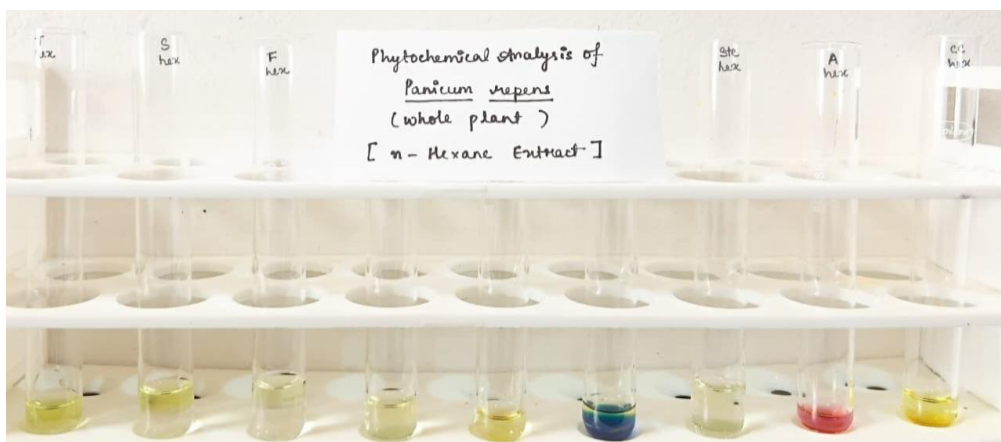


Figure 2: Phytochemical analysis of using n-hexane extract



Figure 3: Phytochemical analysis using ethanolic extract



Figure 4: Phytochemical analysis using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *Panicum repens* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.984	-	-	0.230-0.523
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.984	-	-	0-0.276
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	-	-	-	0.5-0.766

(Rf: Retention factor)

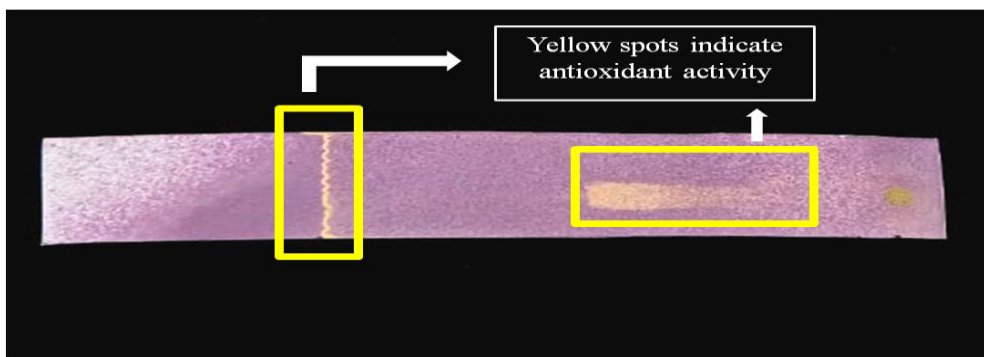


Figure 4: TLC based DPPH analysis using (Ethyl acetate: Methanol: Water)

Other researchers have also documented the different aspects of *Panicum repens*. Study conducted by Shieh et al., (2009) reported a relatively low total polyphenol content (20.7 mg/g chlorogenic acid equivalent) along with weak free radical scavenging activity ($IC_{50} > 250 \mu\text{g/mL}$), suggesting limited antioxidant potential compared to other species evaluated. Crushed internode portion of the *P. repens* has been reported to be filtered and used as eye drop to cure eye irritation by the Lodhas and fresh stolon paste ($\approx 20 \text{ g}$) mixed with black pepper seeds ($\approx 5 \text{ g}$) is taken by the Asurs to treat piles, continuing the medicine for 15 days (Saha et al., 2013). *Panicum* species has been reviewed to have diuretic, antibacterial, hypolipidemic, anti-inflammatory, antipyretic, and antifungal activities (Saha et al., 2013). Temraz et al., (2014)

also reported isolation of four new steroids from ethanolic roots and rhizome extract of *P. repens* three of which possessed cholestane structure alongside isolation and characterization of five spirostane saponins. *P. repens* referred as Luci ghas locally has been reported to be found in fields of Basti Bazar of study areas and valued for reclaiming saline soils. Ethnobotanical reports highlight its use in treating sores, wounds, cough, cancer, and use of leaves in stopping bleeding (Mustafa et al., 2023). In recent survey reports, *P. repens* has been reported to be commonly found in wetlands, riverbanks, and agricultural fields but palatability and nutritional value as a food source for livestock is comparatively low among the other grasses (Behera et al., 2025). The above reports indicated that less works are carried out in antioxidant aspects as well as restoration for herbivorous.

CONCLUSION

Panicum repens emerges as a useful grass species with strong ecological, and ethnopharmacological significance. Its role as an efficient soil stabilizer and agent of erosion control makes it ecologically valuable in disturbed and fragile landscapes. At the same time, its contribution as a fodder resource provides a dependable and nutritious food source for both wildlife and livestock, especially under challenging climatic conditions. Preliminary phytochemical and antioxidant findings further highlight its potential as a reservoir of bioactive compounds, reinforcing its importance in natural product research. Taken together, *P. repens* exemplifies how an underexplored grass species can integrate ecological services with prospects for future pharmacological applications, warranting further detailed investigation.

REFERENCES

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Brecke BJ, Unruh JB and Dusky JA. (2001). Torpedo grass (*Panicum repens*) Control with Quinclorac in Bermuda grass (*Cynodon dactylon* × *C. transvaalensis*) Turf. Weed Technology. 15: 732-736.

- Fatima I, Kanwal S and Mahmood T. (2018). Evaluation of biological potential of selected species of family Poaceae from Bahawalpur, Pakistan. BMC Complementary and Alternative Medicine. 18(1): 27.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. Journal of Biodiversity and Conservation. 9(2): 87-107.
- Knez M, Ranić M and Gurinović M. (2023). Underutilized plants increase biodiversity, improve food and nutrition security, reduce malnutrition, and enhance human health and well-being. Let's put them back on the plate!. Nutrition Reviews. 82(8): 1111-1124.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. International Journal of Pharmaceutical Sciences Review and Research. 18(1): 126-132.
- Muhammad M, Waheed A, Wahab A, Majeed M, Nazim M, Liu YH, Li L and Li WJ. (2024). Soil salinity and drought tolerance: An evaluation of plant growth, productivity, microbial diversity, and amelioration strategies. Plant Stress. 11: 100319.
- Mustafa A, Hanif U, Sardar AA and Jan HA. (2023). Ethnomedicinal study of medicinal plants used by the population of Taunsa Sharif, Dera Ghazi Khan, Punjab, Pakistan. Ethnobotany Research and Applications. 26: 1-27.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. World Journal of Pharmaceutical Research. 13(2): 674-680.
- Saha A, Hoque A, Mallick SK and Panda A. (2013). Medicinal Uses of Grasses by the Tribal People in West Bengal - An Overview. International Journal of Basic and Applied Sciences. 3(3): 63-70.

- Shieh PC, Agoramoorthy G and Kuo DH. (2009). Evaluation of Antioxidant Polyphenols in Taiwan's Medicinal Plants. Asian Journal of Chemistry. 21(7): 5556-5562.
- Temraz A, Hozaien HE, El-Tantawy WH, El-Gindi OD and Taha KF. (2014). Cholestane and spirostane-type glycosides from the roots and rhizomes of *Panicum repens* L. Phytochemistry Letters. 10: 173-178.

Chapter 2

Phytochemical analysis and antioxidant activity of *Ottochloa nodosa* (Poaceae)

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ABSTRACT

Ottochloa nodosa, a lesser-known member of the Poaceae family, was evaluated for its phytochemical constituents and antioxidant potential. Qualitative phytochemical screening of whole plant extracts (n-hexane, ethanol, and aqueous) revealed the presence of tannins, saponins, reducing sugars, and phenolic compounds, while flavonoids, terpenoids, steroids, and alkaloids were absent. Thin Layer Chromatography-based 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) analysis confirmed antioxidant activity, with distinct retention spots and streaks observed across solvent systems, indicating the presence of compounds with radical scavenging activity. These findings highlight the potential of *O. nodosa* as a reservoir of natural bioactive compounds, warranting further exploration for pharmacological and ecological applications.

Keywords: Antioxidant potential, conservation, grass, qualitative phytochemical screening

INTRODUCTION

Grasses, belonging to the family Poaceae, are ecologically and economically important due to their role in soil stabilization, erosion control, and as a sustainable fodder resource for both wildlife and livestock (Fatima et al., 2018; Behera et al., 2025). Beyond their ecological value, grasses have also been recognized as reservoirs of bioactive compounds (Verhulst et al., 2023) with antimicrobial, antioxidant, anti-inflammatory, anti-diabetic, and various therapeutic properties, making them increasingly relevant in natural product research (Gebashe et al., 2020). *Ottochloa nodosa* (Figure 1) is a perennial grass species widely distributed in moist and disturbed habitats. Although primarily studied as a groundcover species with soil-stabilizing properties, it is widely recognized as a weed. Hence, little attention has been given to its phytochemistry or potential pharmacological significance. Different bioactive compounds are often present in grasses those play an important role in plant defense mechanisms and have demonstrated medicinal value in traditional systems (Damor et al., 2025). Oxidative stress has been reported to be associated with several neurological diseases like Parkinson's and Alzheimer's disease (Pizzino et al., 2017) and considering the global demand for novel plant-based antioxidants to address oxidative stress-related disorders, exploring underutilized and abundantly present grasses like *O. nodosa* becomes highly relevant. It stands as one of those quiet grasses that thrive in the background of ecosystems, yet its scientific story is still largely unwritten. In the era of growing interest in natural product research, its silence in literature is striking, an untapped thread waiting to be woven into pharmacological and ecological narratives. The scarcity of focused studies not only leaves its medicinal promise in obscurity but also overlooks its contribution to soil resilience and biodiversity. The present study aims to investigate the phytochemical composition of *O. nodosa* and assess its antioxidant activity using TLC-based DPPH analysis. Such baseline information may contribute towards positioning this overlooked grass as an ecologically viable source of natural compounds for pharmacological and nutraceutical applications.



Figure 1: Collected sample of *Ottochloa nodosa*

METHODOLOGY

Whole plants of *Ottochloa nodosa* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India. The plant species was identified by the author. Whole plant was thoroughly washed under running tap water to remove dust. They were cut into small pieces and using Soxhlet method, extraction (n-hexane, ethanol and aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was carried out using standard methods (Jena et al., 2025; Kumar et al., 2013, Pattnaik and Bhatnagar, 2023).

RESULTS AND DISCUSSION

Qualitative analysis of the whole plant using different solvent extracts revealed the presence of several bioactive compounds (Table 1; Figure 2-4). Tannins, saponins, and reducing sugars were consistently detected in ethanol and aqueous extracts. Phenolic compounds were found in ethanol and aqueous extracts, while no bioactive compounds were detected in the n-hexane extract. Other secondary metabolites, including flavonoids, terpenoids, steroids, carbonyl compounds and alkaloids, were absent in all extracts. These results indicate that *O. nodosa* contains a selective range of phytochemicals, dominated by tannins, saponins, reducing sugars, and certain phenolics. The TLC-based DPPH assay of the aqueous extract confirmed antioxidant activity across different solvent systems (Table 2). In the ethyl acetate: methanol: distilled water (40:5.4:4) system, active bands appeared at R_f values of 0.384 and 0.476. The chloroform: ethyl acetate: formic acid (5:4:1) system produced a strong antioxidant spot at R_f 0.904 and a streak between 0 to 0.761, suggesting the presence of a broad spectrum of radical scavenging compounds. In the n-hexane: petroleum ether: ethanol (1:1:8) system, an antioxidant spot at R_f 0.5 and a streak extending from 0.5 to 0.766 were observed. These findings demonstrated the presence of multiple antioxidant constituents of varying polarity in *O. nodosa*.

Table 1: Qualitative phytochemical analysis of *O. nodosa*

Polarity	Extracts	Detected secondary metabolites
Non-Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin, Phenolic compounds and Reducing sugars
	Aqueous	Tannin, Saponin, Phenolic compounds and Reducing sugars
Polar		

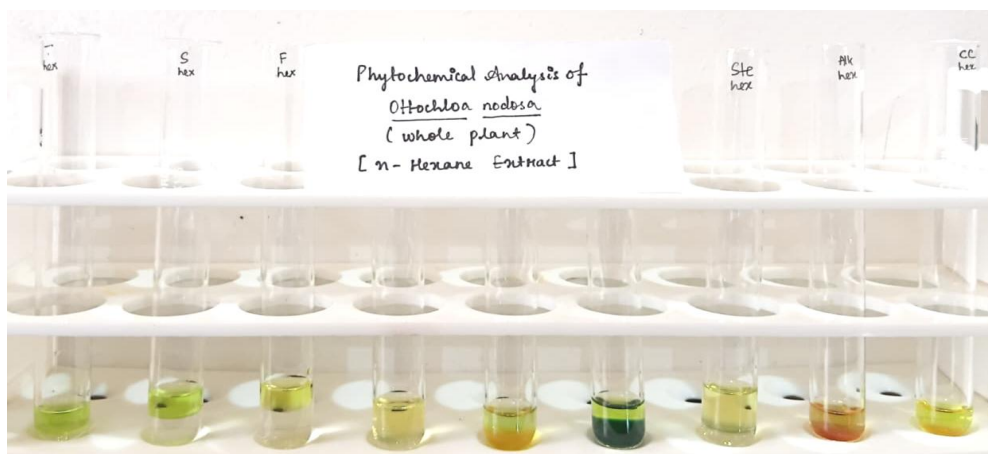


Figure 2: Phytochemical analysis of *O. nodosa* using n-hexane extract

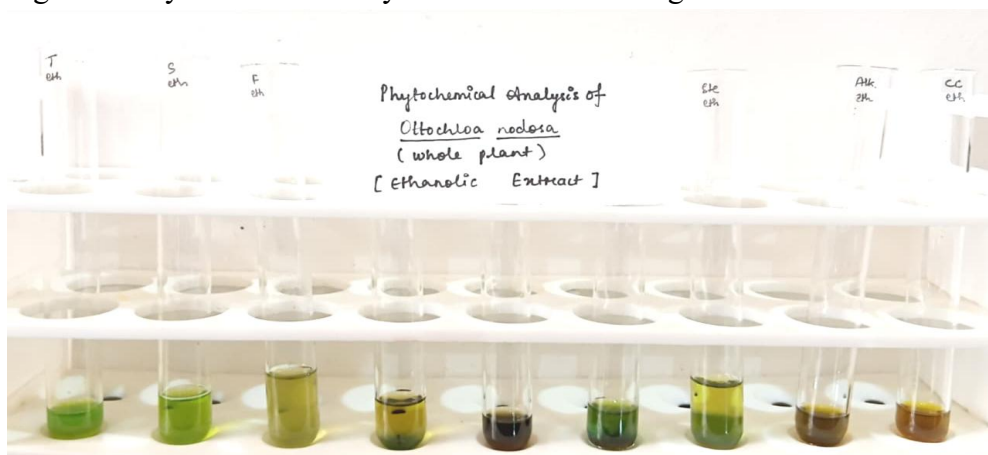
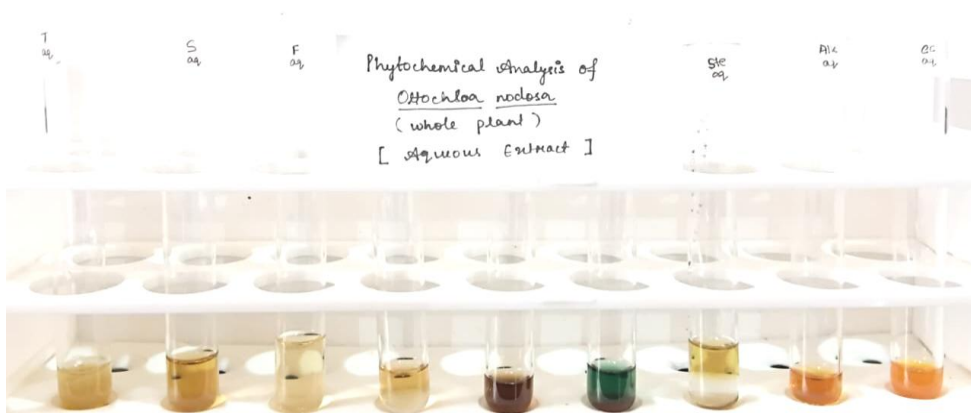


Figure 3: Phytochemical analysis of *O.nodosa* using ethanolic extract

Figure 4: Phytochemical analysis of *O.nodosa* using aqueous extractTable 2: TLC-based DPPH analysis of *O.nodosa*

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.384	0.476	-	-
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.904	-	-	0 to 0.761
	n-Hexane: Petroleum ether: Ethanol (1: 1: 8)	0.5	-	-	0.5 to 0.766

(Rf: Retention factor)

Other researchers have also studied different aspects of *Ottochloa nodosa*. A study conducted on freeze-dried whole plant extracts of *O. nodosa* (Latib et al., 2022) showed presence of secondary metabolites like saponin, tannin, flavonoid and alkaloid during phytochemical screening. While, the GC-MS analysis of crude extract detected nine active components (Gokul and Thomas, 2023) *i.e.* 9,12-octadecadienoate acid (Z, Z)-, 6-octadecanoic acid, methyl, 9,12-heptadecadienoate, trans-13-octadecanoic acid, 9,17-octadecadienal, cisvaccenic acid, butyl 9,12-octadecadienoate, octadecanoic acid, and oleic acid. Also using morphological traits and Beeli's digital formula (3111.4223), *Meliola panici* was identified which is an obligate

biotrophic fungi frequently reported on grasses of the Poaceae family. Gokul and Thomas, 2023 presented the first report of *M. panici* occurring on *O. nodosa*. This documentation contributed towards host-pathogen interactions and highlighted the ecological relevance of fungal associates in grasses. Research on *O. nodosa* remains sparse, leaving much of its biological and pharmacological potential unexplored. This lack of focused investigation creates a clear research gap, which, if addressed, could reveal novel and deeper insights into its bioactive profile and ecological contributions.

CONCLUSION

This study established *Ottochloa nodosa* as a promising source of natural antioxidants, with screening of key phytochemicals such as tannins, saponins, and phenolic compounds contributing to its bioactivity. Its dual ecological role as a soil stabilizer and fodder grass, along with its bioactive potential, reinforces its significance as an ecologically viable and pharmacologically relevant species. Future studies focusing on isolation, characterization, and biological evaluation of its active constituents could expand its utility in natural product research and sustainable medicine.

REFERENCES

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Damor K, Kadia R and Modi N. (2025). A review of phytochemical and pharmacological analysis of Poaceae family plants. International Journal of Scientific Research in Science and Technology. 12(1): 450-462.
- Fatima I, Kanwal S and Mahmood T. (2018). Evaluation of biological potential of selected species of family Poaceae from Bahawalpur, Pakistan. BMC Complementary and Alternative Medicine. 18(1): 27.

- Gebashe F, Aremu AO, Gruz J, Finnie JF and Van Staden J. (2020). Phytochemical profiles and antioxidant activity of grasses used in South African traditional medicine. *Plants*. 9(3): 371.
- Gokul GN and Thomas J. (2023). First report of *Meliola panici* on *Ottochloa nodosa* (Kunth) Dandy (Poaceae). *Journal of Threatened Taxa*. 15(2): 22761-22763.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Latib NA, Desa S and Ngah CWZCW. (2022). The detection of phytochemical properties from freeze dried *Ottochloa nodosa* (Kunth) Dandy extracts and its potential as a bacterial inhibitor. *Journal of Science and Mathematics Letters*. 10(1): 66-78.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Pizzino G, Irrera N, Cucinotta M, Pallio G, Mannino F, Arcoraci V, Squadrito F, Altavilla D and Bitto A. (2017). Oxidative stress: harms and benefits for human health. *Oxidative Medicine and Cellular Longevity*. 2017: 8416763.
- Saha A, Hoque A, Mallick SK and Panda A. (2013). Medicinal uses of grasses by the tribal people in West Bengal - an overview. *International Journal of Basic and Applied Sciences*. 3(3): 63-70.
- Verhulst EP, Brunton NP and Rai DK. (2023). Polyphenols in agricultural grassland crops and their health-promoting activities-a review. *Foods*. 12(22): 4122.

Chapter 3

Phytoconstituents and antioxidant properties of *Bothriochloa pertusa* (L.) A.Camus (Poaceae): an ecological perspective

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ABSTRACT

Bothriochloa pertusa, a perennial grass commonly found along roadsides, is widely distributed in India. This study evaluated its phytochemicals and antioxidant activity using qualitative screening and thin-layer chromatography (TLC) based 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. Results revealed that non-polar extracts yielded no detectable secondary metabolites, while ethanol and aqueous extracts showed tannins, saponins, flavonoids, and reducing sugars. TLC-DPPH analysis revealed diverse radical-scavenging compounds with varying R_f values, confirming the plant's antioxidant potential. These findings highlight *B. pertusa* as both an ecologically valuable forage species and a source of natural antioxidants.

Keywords: Fodder grass, bioactive compounds, conservation, pharmacology

INTRODUCTION

The genus *Bothriochloa* of the family Poaceae is a widely distributed group of grasses, represented by about 38–40 species worldwide, of which 38 have been formally identified (POWO, 2023). In India, 13 species occur, with 6 considered endemic (Kellong et al., 2020). About three species of this genus are recorded from Odisha state (Mane et al., 2023). Of these, *B. pertusa*, known commonly as Pitted beard grass or Indian bluegrass, has attracted particular attention. A perennial C₄ species, it is native to tropical and subtropical regions but now stretches across Asia, Africa, and Oceania. Its photosynthetic efficiency enables it to capture carbon effectively, contributing to long-term carbon sequestration in soils (Yadav and Mishra, 2020). In Odisha, however, *B. pertusa* is more often seen in ordinary settings like open grasslands, roadside patches, and even neglected wastelands, where it is dismissed as a common weed (Behera et al., 2025). Yet, this simple grass hides remarkable ecological adaptations: it thrives in drought, withstands poor soils, and tolerates high temperatures, making it a dependable survivor in arid and semi-arid landscapes. Such resilience allows it to perform crucial ecological functions. Like many grasses of savannas and rangelands, it helps stabilize soil, curb erosion, and maintain the structural fabric of habitats essential for diverse plants and animals (Bengtsson et al., 2019). Instead of investing in tall above-ground biomass, it spreads through a dense mat of stolons that carpets the ground. This continuous cover not only resists grazing (Lebbink and Fensham, 2023) but also allows the species to flourish under heavy stocking once it colonizes bare patches. At the same time, its stoloniferous cover provides palatable forage for both domestic livestock and wild herbivores, ensuring a steady food base for pastoral livelihoods and wildlife alike. Year-round availability, combined with its ground-covering growth, enhances ecosystem resilience by supporting biodiversity and facilitating nutrient cycling (Lebbink and Fensham, 2023). Beyond its ecological role, *B. pertusa* also carries medicinal and pharmacological significance. Therefore, a try has been made to study its bioactive constituents that can connect its ecological importance with therapeutic relevance, positioning *B. pertusa*

not only as a cornerstone of grazing systems but also as a reservoir of natural compounds with potential applications in health and medicine.

METHODOLOGY

Whole plants of *Bothriochloa pertusa* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by authors followed by published literature (Behera et al., 2025). Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and using Soxhlet method extraction (n-hexane, ethanol and aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was done using standard methods (Kumar et al., 2013; Pattnaik and Bhatnagar, 2023; Jena et al., 2025).

RESULTS AND DISCUSSION

The phytochemical screening of *Bothriochloa pertusa* showed that solvent polarity plays a key role in extracting metabolites (Table 1; Figure 2–4). Non-polar extracts (n-hexane) yielded no detectable compounds or activity, whereas polar solvents like ethanol and water extracted bioactive constituents. Ethanol extract contained tannins and reducing sugars, while the aqueous extract showed tannins, saponins, flavonoids, and reducing sugars. TLC-based DPPH (2,2-Diphenyl-1-picrylhydrazyl) assay of the aqueous extract further confirmed its antioxidant potential (Table 2; Figure 5). The ethyl acetate: methanol: water system produced a prominent spot at R_f 0.982 with streaking (0.384–0.711), and the chloroform: ethyl acetate: formic acid system showed a spot at R_f 0.960 with streaking (0.196–0.313), indicating compounds of varying polarities contributing to radical scavenging. In contrast, the n-hexane: petroleum ether: ethanol system yielded a single spot at R_f 0.540 (Figure 5), reflecting limited antioxidant diversity.

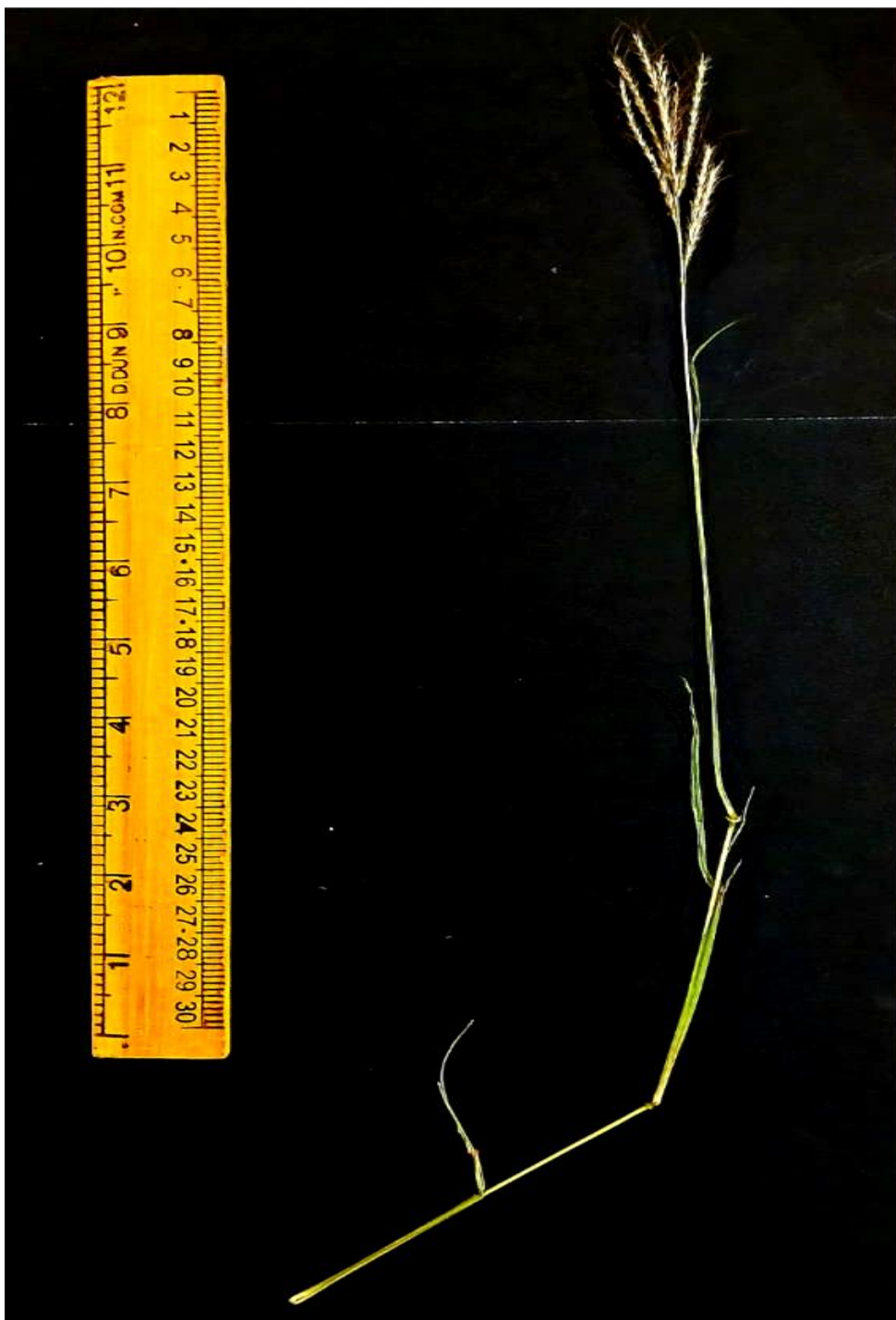


Figure 1: Plant parts of *Bothriochloa pertusa*

Table 1: Qualitative phytochemical analysis of *B. pertusa*

Polarity	Extract	Detected secondary metabolites
Non-Polar ↓ Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin and Reducing sugars
	Aqueous	Tannin, Saponin, Flavonoid and Reducing sugars

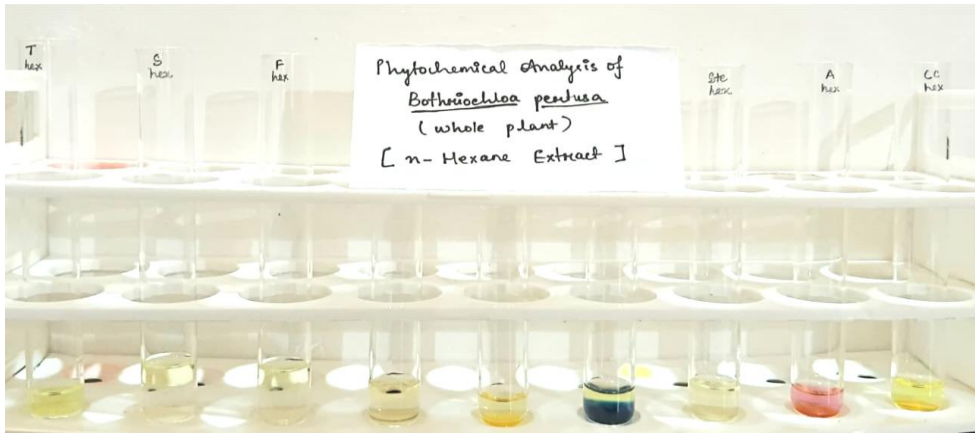


Figure 2: Phytochemical analysis of *B. pertusa* using n-hexane extract



Figure 3: Phytochemical analysis of *B. pertusa* using ethanolic extract



Figure 4: Phytochemical analysis of *B. pertusa* using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *B. pertusa* using different mobile phases

	Mobile Phases	Rf value of Spots	
		S1	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.982	0.384 – 0.711
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.960	0.196 – 0.313
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.540	-

(Rf: Retention factor)

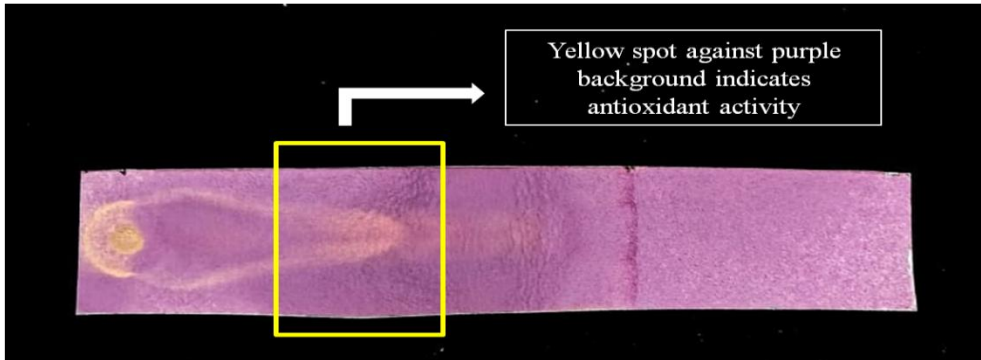


Figure 5: Antioxidant activity of *B. pertusa*

Other researchers have also documented the different aspects of *B. pertusa*. The essential oil composition of *B. pertusa* has been studied (Kaul and

Vats, 1998), revealing the presence of oxygenated sesquiterpenes such as intermedeol and acorenone-B, which contribute to its bioactivity and can be an essential data to support the potential bioactivity of the present secondary metabolites. A survey conducted in different parts of West Bengal (Saha et al., 2013) revealed that among the Lodhas, a decoction of fresh inflorescence of *B. pertusa* mixed with *Piper longum* (3:1) is given to children for cold and cough and the Mundas use powdered ripe grains of the same mixed with *Piper nigrum* in lukewarm water for treating breast tumors in women, administered for 15 days with advice to avoid alcohol. Apart from these, there is a research gap between its use as forage and pharmacological values that needs to be addressed.

CONCLUSION

The present study demonstrated *Bothriochloa pertusa* to possess a range of polar phytochemicals with the aqueous extract proving to be the richest source of secondary metabolites such as tannins, saponins, flavonoids, and reducing sugars. TLC-DPPH assay further confirmed the antioxidant potential of this grass with different solvent systems revealing distinct R_f values and streaking patterns that highlighted the diversity of radical-scavenging molecules. These findings suggest that aqueous extracts of *B. pertusa* hold promising antioxidant properties, which could be explored further for potential applications in natural therapeutics and plant-based formulations. Nevertheless, research on this species remains limited, and further studies are needed to gain a deeper understanding on its potential. Expanding knowledge of its phytochemicals and pharmacological properties could provide valuable information, while future investigations may also clarify its ecological, forage, and practical applications in broader areas.

REFERENCES

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Bengtsson J, Bullock JM, Egoh B, Everson C, Everson T, Connor TO, Farrell PJO, Smith HG and Lindborg R. (2019). Grasslands—more

important for ecosystem services than you might think. *Ecosphere*. 10(2): e02582.

- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Kaul VK and Vats SK. (1998). Essential oil composition of *Bothriochloa pertusa* and phyletic relationship in aromatic grasses. *Biochemical Systematics and Ecology*. 26(3): 347-356.
- Kellogg E, Abbott JR, Bawa K, Gandhi K, Kailash BR, Ganeshiah KN, Babu SU and Raven P. (2020). Checklist of the grasses of India. *PhytoKeys*. 163: 1-560.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Lebbink G and Fensham R. (2023). The ‘lawnification’ of Australia’s eastern grassy woodlands: the past, current and likely future spread of an invasive perennial grass, *Bothriochloa pertusa*. *Biological Invasions*. 25: 1779–1794.
- Mane PR, Swamy J, Panda S, Kamila PK, Mastakar VK, Potdar GG and Salunkhe CB. (2024). The genus *Bothriochloa* (Poaceae: Andropogoneae) in Odisha: with an addition of species *Bothriochloa kuntzeana* (Hack.) Henrard. *Vegetos*. 38: 1469-1474.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Plants of the World Online (POWO). (2023). The Royal Botanic Gardens, Kew.

- Saha A, Hoque A, Mallick SK and Panda A. (2013). Medicinal Uses of Grasses by the Tribal People in West Bengal - An Overview. *International Journal of Basic and Applied Sciences*. 3(3): 63-70.
- Shieh PC, Agoramoorthy G and Kuo DH. (2009). Evaluation of antioxidant Polyphenols in Taiwan's medicinal plants. *Asian Journal of Chemistry*. 21(7): 5556-5562.
- Yadav S and Mishra A. (2020). Ectopic expression of C₄ photosynthetic pathway genes improves carbon assimilation and alleviate stress tolerance for future climate change. *Physiology and Molecular Biology of Plants*. 26(2): 195-209.

Chapter 4

Ecological resilience and phytopharmacological aspects of *Saccharum spontaneum* L. (Poaceae)

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ABSTRACT

Present study investigated the bioactive compounds and antioxidant activity of flowers of *Saccharum spontaneum*, a perennial grass of ecological and medicinal importance. Qualitative screening showed that polar solvents (ethanol and water) contained tannins, saponins, phenols, and reducing sugars, with the aqueous extract being the richest. Antioxidant activity, evaluated through Thin Layer Chromatography (TLC)-based 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay, revealed multiple radical-scavenging spots, especially in the ethyl acetate: methanol: water system, indicating diverse antioxidant constituents. The findings provide a scientific basis for its traditional medicinal use and support its future application in natural product development.

Keywords: Antioxidant potential, phytochemical profile, traditional medicine

INTRODUCTION

Saccharum spontaneum L., commonly known as ‘Wild Sugarcane’ or ‘Kans,’ is a perennial grass belonging to the family Poaceae. It is widely distributed across tropical and subtropical regions, thriving in diverse habitats such as riverbanks, grasslands, and wastelands (Behera et al., 2025). Ecologically, it plays a vital role in maintaining soil stability, preventing erosion, and aiding in the natural regeneration of degraded lands. Its extensive rhizome system improves soil structure and moisture retention, thereby enhancing ecosystem resilience (Pandey et al., 2014) and serving as a pioneer species in disturbed environments. Beyond its ecological functions, *S. spontaneum* holds considerable potential as a sustainable bioresource. The plant’s high biomass yield and tolerance to salinity, drought, and heavy metals make it suitable for bioenergy production, phytoremediation, and ecological restoration projects (Pandey et al., 2014). Its ability to accumulate and stabilize soil nutrients contributes to carbon sequestration and soil fertility improvement, aligning with global goals for ecosystem sustainability and climate change mitigation (Da Silva, 2017). Such attributes underline the importance of integrating *S. spontaneum* into both environmental management and industrial applications. Pharmacologically, *S. spontaneum* has been recognized in traditional medicine for its diverse therapeutic applications. Ayurveda has acknowledged its medicinal value for the treatment of various gynaecological and respiratory problems (Hassan et al., 2024). Various parts of the plant, including roots, leaves, and stems, are reported to possess antioxidant, anti-inflammatory, antimicrobial, and diuretic properties (Lamba et al., 2023). Its medicinal potential is largely governed by the presence of bioactive compounds, which contribute to its efficacy as a traditional remedy and its tolerance against both abiotic and biotic stresses (Chandra et al., 2024). Recent studies have further suggested its role in gastrointestinal disorders and wound healing, indicating its pharmacological relevance. Although scientific evaluations have been conducted on *S. spontaneum*, efforts toward translating its bioactive potential into viable products remain limited from flowers, highlighting the need for further research focused on formulation development and practical applications.

METHODOLOGY

Whole plants of *Saccharum spontaneum* L. were collected from Nayagarh district, Odisha, India (Figure 1). The plant species was identified by authors using published flora book (Behera et al., 2025). Flowers were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and using Soxhlet method extraction (n-hexane, ethanol and aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was done using standard methods (Kumar et al., 2013; Pattnaik and Bhatnagar, 2023; Jena et al., 2025).

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Saccharum spontaneum* flowers revealed that solvent polarity played a major role in determining metabolite extraction. Non-polar fractions showed no detectable compounds, whereas polar extracts yielded diverse secondary metabolites (Table 1; Figure 2-4). The n-hexane extract contained only reducing sugars, while the ethanol extract contained tannins and reducing sugars. The aqueous extract was the richest, showing tannins, saponins, phenols, and reducing sugars, indicating a higher concentration of polar bioactive compounds. TLC-based DPPH analysis of the aqueous extract confirmed its antioxidant potential (Table 2).

Table 1: Qualitative phytochemical analysis of *S. spontaneum* (flowers)

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	Only Reducing sugars
	Ethanol	Tannin and Reducing sugars
	Aqueous	Tannin, Saponin, Phenol and Reducing sugars



Figure 1: Plant parts of *Saccharum spontaneum*

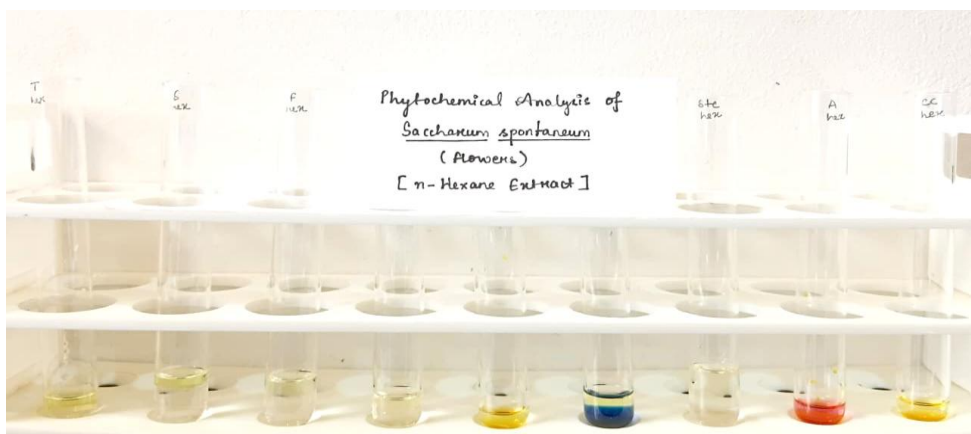


Figure 2: Phytochemical analysis of *S. spontaneum* using n-hexane extract

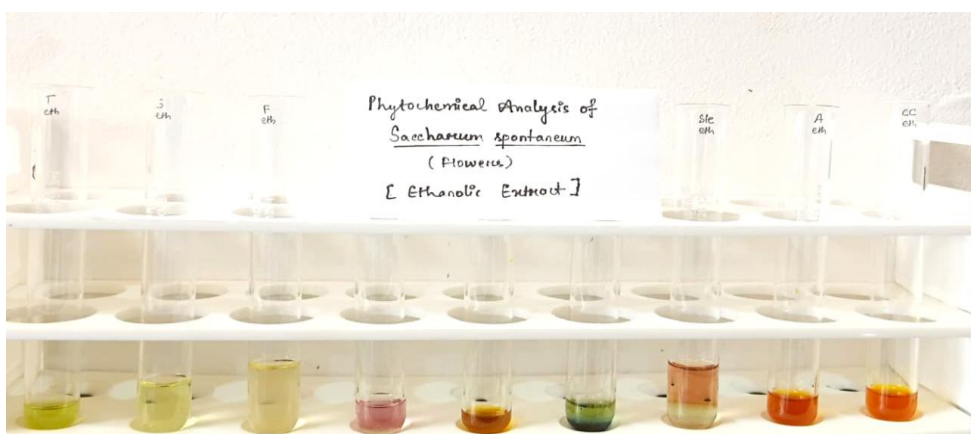


Figure 3: Phytochemical analysis of *S. spontaneum* using ethanolic extract



Figure 4: Phytochemical analysis of *S. spontaneum* using aqueous extract

The ethyl acetate: methanol: water system produced distinct spots at Rf 0.716 and 0.85, with a streak between 0.416–0.983, suggesting multiple antioxidant components. The chloroform: ethyl acetate: formic acid system showed a prominent spot at Rf 0.983, while the n-hexane: petroleum ether: ethanol system displayed minimal activity (Figure 5), reflecting limited antioxidant diversity.

Table 2: TLC-based DPPH analysis of whole plant extract of *S. spontaneum* using different mobile phases

	Mobile Phases	Rf value of Spots		
		S1	S2	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.716	0.85	0.416 – 0.983
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.983	-	0 – 0.209
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	-	-	0 – 0.403

(Rf: Retention factor)

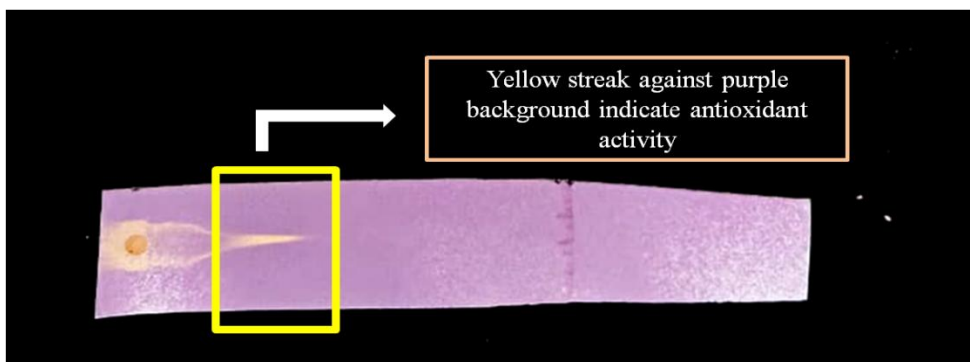


Figure 5: Antioxidant activity of *Saccharum spontaneum*

Other investigations have examined diverse properties of *S. spontaneum*. Various stem extracts of the plant have been reported to contain a diverse range of bioactive compounds in both in whole and powdered form (Kumar et al., 2009). Stems are beneficial for conditions like burning sensation, hemorrhoids and agalactia phthisis (Kumar et al., 2010). Different *in-vitro* antioxidant tests showed potent free radical scavenging activity by *S.*

spontaneum root extracts (Sathya and Kokilavani, 2013) that indicated its potential as a source of natural therapeutic agent. According to Ayurveda, aerial parts and even the whole plant is useful in treatment of blood diseases, biliousness, hemorrhagic diathesis, burning sensations, strangury, phthisis, vesical calculi, gynecological problems, vomiting and various mental conditions (Hussain et al., 2014; Amutha et al., 2016). Komathi and Durai (2015) reviewed the leaves to contain carbohydrate, proteins, lignin and amino acids that could have potential radical scavenging activity. The grass is also considered as a superior substrate for synthesis of ethanol due to high carbohydrate content (Hassan et al., 2024).

CONCLUSION

Saccharum spontaneum exemplifies a species of high ecological and pharmacological value, bridging the gap between environmental sustainability and therapeutic utility. Its ability to thrive under harsh conditions contributes to ecosystem restoration, while its diverse phytochemical profile supports various medicinal properties. The present study showed the plant's resilience, coupled with its abundance of bioactive compounds, highlighting its potential for antioxidant activity. Although substantial research has been conducted on its biological and ecological aspects, translating this knowledge into commercially viable formulations and applied technologies remain as an emerging challenge. Future work should therefore emphasize on product-oriented studies that integrate phytochemical profiling, pharmacological validation, and ecological sustainability.

REFERENCES

Amutha IDJ, Senthilkumar SR, Cholaraja K, Periyasamy R, Rajkumar A, Ramya J and Saraswathi K. (2016). Antioxidant activities and total flavonoids content of various extracts from aerial parts of *Saccharum spontaneum* (Linn.). International Journal of Chemical and Pharmaceutical Sciences. 7(4): 79-83.

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Chandra S, Kumar M, Bala A, Kaur H, Mishra S and Kumar S. (2024). Medicinal Poaceae of India, Volume 1. Ambika Prasad Research Foundation, Odisha, India.
- Da Silva JA. (2017). The importance of the wild cane *Saccharum spontaneum* for bioenergy genetic breeding. Sugar Tech. 19(3): 229-240.
- Hassan A, Malik K, Naqvi SAM, Sadia H and Khan K. (2024). A comprehensive review of *Saccharum spontaneum*, its traditional uses, phytochemistry and pharmacology. Ethnobotany Research and Applications. 29(5): 1-13.
- Hussain M, Khan MRU, Raza SM, Aziz A, Bakhsh H, Majeed A and Mumtaz F. (2014). Assessment of antibacterial potential of *Saccharum spontaneum* Linn. (family: Poaceae), against different pathogenic microbes-an in vitro study. Journal of Pharmacy and Alternative Medicine. 3(3):36.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. Journal of Biodiversity and Conservation. 9(2): 87-107.
- Komathi S and Durai MF. (2015). Qualitative phytochemical screening of *Saccharum spontaneum* Linn., leaf extracts. Journal of Academia and Industrial Research. 4(6): 168-170.
- Kumar CAS, Varadharajan R, Muthumani P, Meera R, Devi P and Kameswari B. (2009). Pharmacognostic and Preliminary Phytochemical Investigations on the stem of *Saccharum spontaneum*. Journal of Pharmaceutical Sciences and Research. 1(3): 129-136.

- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Lamba D, YR SK and Yadav M. (2023). Pharmacological activities of *Saccharum spontaneum*: a review. *World Journal of Pharmacy and Pharmaceutical Sciences*. 12(5): 1945-1955.
- Pandey VC, Bajpai O, Pandey DN and Singh N. (2014). *Saccharum spontaneum*: an underutilized tall grass for revegetation and restoration programs. *Genetic Resources and Crop Evolution*. 62(3): 443-450.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Sathya M and Kokilavani R. (2013). Phytochemical Screening and In Vitro Antioxidant Activity of *Saccharum spontaneum* Linn. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 75-79.

Chapter 5

Qualitative phytochemical analysis and antioxidant activity of *Leersia hexandra* Sw. (Poaceae)

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ABSTRACT

Leersia hexandra is a perennial aquatic grass and known for its ecological adaptability and medicinal properties. Present study aimed to evaluate the phytochemicals and antioxidant activity of *L. hexandra*. Phytochemical analysis revealed that solvent polarity strongly influenced metabolite extraction. Non-polar extracts did not show detectable compounds, whereas ethanol and aqueous extracts contained tannins, flavonoids, and reducing sugars. The aqueous extract exhibited the highest richness of bioactive compounds and antioxidant activity. The ethyl acetate: methanol: water system showed strong radical scavenging activity with an Rf of 0.983, followed by moderate activity in chloroform: ethyl acetate: formic acid and minimal response in non-polar solvents. The results highlighted the predominance of polar bioactive compounds in *L. hexandra*, supporting its potential as a natural antioxidant source and a candidate for future pharmacological and ecological applications as fodder grass.

Keywords: Antioxidant activity, fodder grass, phytochemical analysis, pharmacological applications

INTRODUCTION

Traditionally, grasses of the Poaceae family have been used in herbal formulations due to their wide range of secondary metabolites (Ishihara, 2021) such as flavonoids, tannins, phenolics, and saponins which are known for their antioxidant (Gebashe et al., 2020), antimicrobial (Mukarram, 2021) and anti-inflammatory effects (Limantol et al., 2022). Antioxidants derived from plants (Farma et al., 2023) play a critical role in neutralizing reactive oxygen species (ROS), which are responsible for oxidative stress and associated cellular damage (Gebashe et al., 2020). Identifying natural sources of antioxidants is therefore essential for the development of phytotherapeutic products and the promotion of health through natural remedies. *Leersia hexandra*, commonly known as southern cutgrass or rice cutgrass. It is widely distributed across India, thriving in wetlands, paddy fields, and along riverbanks (Behera et al., 2025). This species is known for its ability to grow under submerged and nutrient-deficient conditions, making it a vital component of wetland ecosystems where it contributes to soil stabilization, water purification, and habitat restoration. Its dense root and rhizome network helps in preventing erosion, improving sediment retention, and facilitating the natural regeneration of degraded landscapes (Trinidad et al., 2017). Beyond its ecological importance, *L. hexandra* plays a valuable role in sustainable source of fodder for livestock and wildlife along with phytoremediation properties (Chen et al., 2022). However, despite these ecological and economic advantages, the species remains underexplored in terms of its bioactive compounds and pharmacological potential. The present study was thus undertaken to investigate the phytochemical composition and qualitative antioxidant potential of *L. hexandra* by correlating solvent polarity with the extraction of bioactive compounds and highlight its possible pharmacological and ecological applications. The findings are expected to contribute to a broader understanding of this grass species as a natural reservoir of antioxidants and a potential eco-friendly resource for bioprospecting and sustainable utilization.

METHODOLOGY

Whole plants of *Leersia hexandra* were collected from Athgarh, Cuttack district, Odisha, India (Figure 1). The plant species was identified by authors (Behera et al., 2025). Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and using Soxhlet method extraction (n-hexane, ethanol and aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was done using standard methods (Jena et al., 2025; Kumar et al., 2013, Pattnaik and Bhatnagar, 2023).

RESULTS AND DISCUSSION

The qualitative phytochemical analysis of *Leersia hexandra* revealed that solvent polarity significantly influenced the extraction of secondary metabolites (Table 1). Non-polar fractions did not yield any detectable compounds (Figure 2). In contrast, polar solvents ethanol and water extracted notable bioactive compounds (Table 1). The ethanol extract contained tannins and reducing sugars (Figure 3), while the aqueous extract showed the presence of tannins, flavonoids, and reducing sugars, indicating a higher concentration of polar phytochemicals (Figure 4). The antioxidant potential of the aqueous extract was confirmed through TLC based DPPH assay. The ethyl acetate: methanol: water system produced a spot at R_f 0.983 with streaking between 0.166–0.4, while the chloroform: ethyl acetate: formic acid system yielded a similar R_f value (0.983) but a shorter streak range (0–0.116). These results highlighted the predominance of polar bioactive compounds in *L. hexandra* responsible for its antioxidant potential (Table 2).

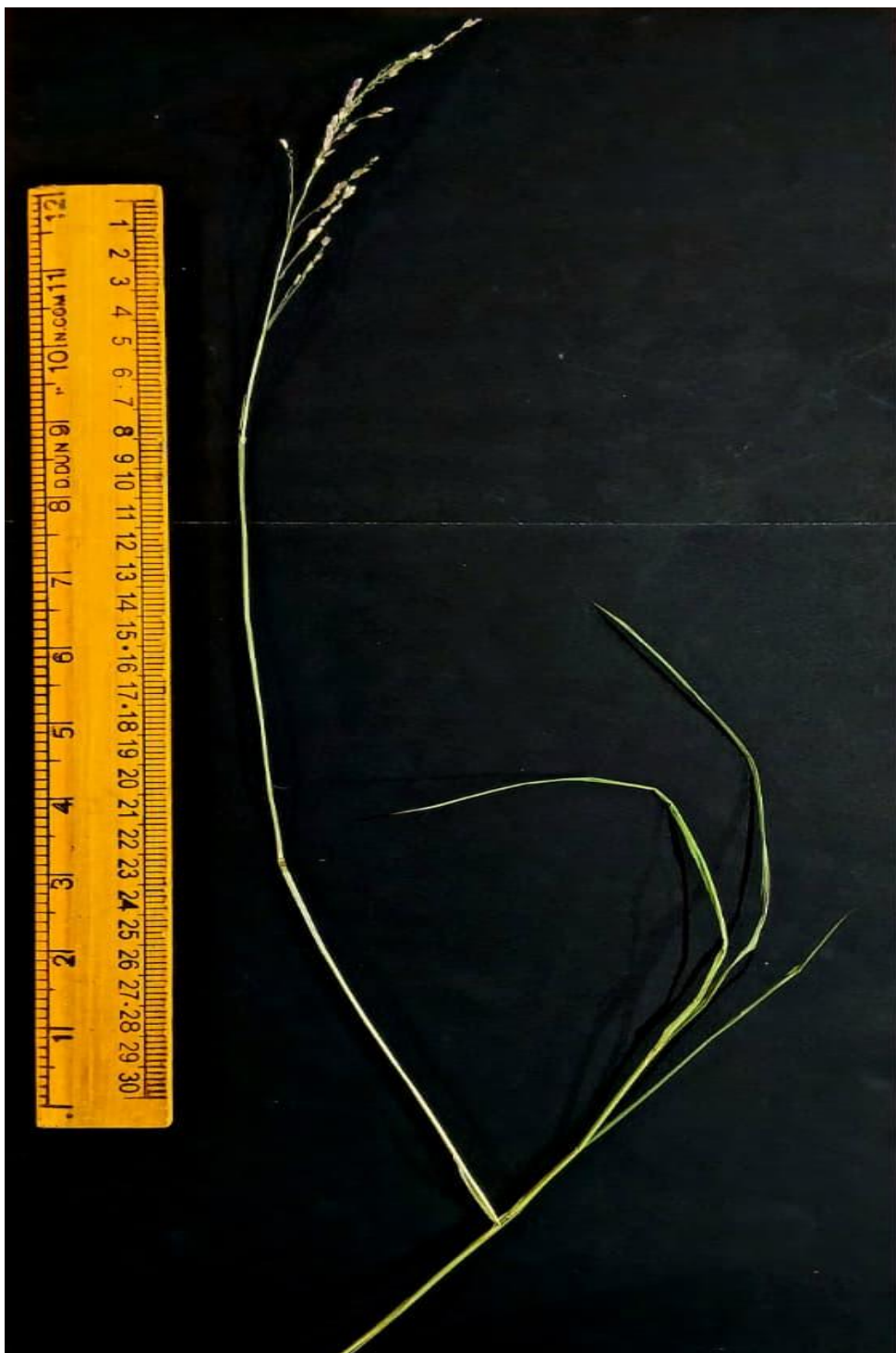


Figure 1: Plant parts of *Leersia hexandra*

Table 1: Qualitative phytochemical analysis of *L. hexandra*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin and Reducing sugars
	Aqueous	Tannin, Flavonoid and Reducing sugars

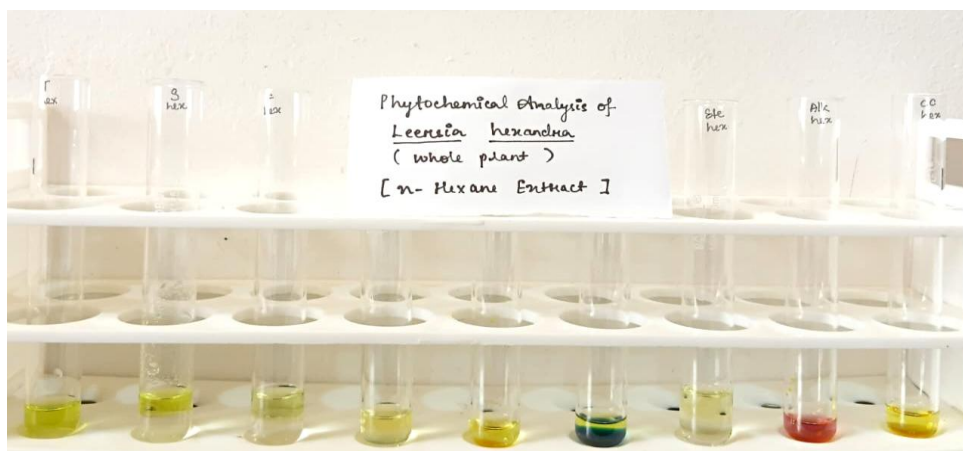
Figure 2: Phytochemical analysis of *L. hexandra* using n-hexane extractFigure 3: Phytochemical analysis of *L. hexandra* using ethanolic extract



Figure 4: Phytochemical analysis of *L. hexandra* using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *L. hexandra* using different mobile phases

	Mobile Phases	Rf value of Spots	
		S1	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.983	0.166 – 0.4
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.983	0 – 0.116
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.75	-

(Rf: Retention factor)

Other researchers have also documented the ecological and traditional aspects of *L. hexandra*. The plant has been reviewed to be used for treating hemoptysis and muscular tiredness (Hariyadi and Ticktin, 2012). Aqueous extract of leaves and stems has been used for treating hypertension in Cameroun and acetone extract of seeds were examined to contain a diverse range of secondary metabolites (Juwitaningsih et al., 2020). Studies have highlighted its capacity to tolerate and accumulate heavy metals such as Chromium, Copper, and Nickel (Chen et al., 2022), indicating its potential for environmental cleanup and wastewater treatment. This grass is used to make a traditional drink called 'aia banto' in West Sumatra, believed to help eliminate bodily toxins, alleviate asthma, and relieve shortness of breath

(Farma et al., 2024), highlighting its ecological value and significant therapeutic potential

CONCLUSION

The phytochemical and antioxidant analysis of *Leersia hexandra* demonstrated that the grass predominantly contains polar bioactive compounds, including tannins, flavonoids, and reducing sugars. The aqueous extract exhibited the most significant antioxidant activity, confirming its potential as a source of natural radical scavengers. These findings not only validate the traditional relevance of *L. hexandra* but also emphasize its value in pharmacological research and ecological restoration. Further studies focusing on compound isolation, structural characterization, and bioefficacy evaluation are recommended to advance its application in natural product development and wildlife management.

REFERENCES

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Chen M, Zhang X, Jiang P, Liu J, You S and Lv Y. (2022). Advances in heavy metals detoxification, tolerance, accumulation mechanisms, and properties enhancement of *Leersia hexandra* Swartz. Journal of Plant Interactions. 17(1): 766–778.
- Farma SA, Kardiman R., Selaras GH and Annisa N. (2024). Evaluation of the phytochemical, total phenolic content, and antioxidant activity of Banto grass (*Leersia hexandra*) using an ecological and ethnobotanical approach. BIO Web of Conferences. 91: 01022.
- Gebashe F, Aremu AO, Gruz J, Finnie JF and Van Staden J. (2020). Phytochemical profiles and antioxidant activity of grasses used in South African traditional medicine. Plants. 9(3): 371.
- Ishihara A. (2021). Defense mechanisms involving secondary metabolism in the grass family. Journal of Pesticide Science. 46(4): 382-392.

- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Juwitaningsih T, Sari SA, Jahro IS, Silaban S and Simorangkir M. (2021). Study of phytochemical, antibacterial activity and toxicity on acetone extract seed *Leersia Hexandra* Sw. *Journal of Physics: Conference Series*. 1811. 012-130.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Limantol AM, Agbemade B, Boamah VE, Mercy B, Amponsah KI, Adam FCN and Mohammed RB. (2022). Antioxidant and anti-inflammatory properties of "Limolanii" grass and perceptions of locals on its survival in the era of changing climate. *Heliyon*. 8(12): e12018.
- Mukarram M, Choudhary S, Khan MA, Poltronieri P, Khan MMA, Kurjak D and Shahid M. (2021). Lemongrass essential oil components with antimicrobial and anticancer activities. *Antioxidants*. 11(1): 20.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical analysis and bio evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Trinidad AA, Cruz MDCR, Garrigós AR, Navarro LAA and Guzmán RQLJH. (2017). Use of *Leersia hexandra* (Poaceae) for soil phytoremediation in soils contaminated with fresh and weathered oil. *Revista de Biología Tropical*. 65(1): 21-30.

Chapter 6

Evaluation of pharmacological values of *Alloteropsis cimicina* (L.) Stapf: a fodder grass

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ABSTRACT

In tropical India, several grass species thrive across diverse ecological strata such as forest fringes, grasslands, and wetlands, contributing to soil stability, nutrient cycling, and wildlife sustenance. Among them, *Alloteropsis cimicina*, a lesser-studied member of the family Poaceae, stands out for its ecological versatility. It can thrive in diverse habitats, which indicate its adaptive defense mechanisms contributing to the development of a wide range of secondary metabolites. These metabolites could be useful as therapeutic and nutraceutical agent. Therefore, qualitative phytochemical and antioxidant analysis were carried out. Results revealed that polar solvents were more effective in extracting bioactive compounds than non-polar solvents. Ethanol and aqueous extracts contained tannins, saponins and reducing sugars while alkaloids were specifically detected in the aqueous extract. Non-polar fractions yielded no detectable compounds. Aqueous extract showed highest antioxidant activity. These results suggest that *A. cimicina* harbors significant polar phytoconstituents with antioxidant properties which validate its therapeutic and nutraceutical potential. It could be useful as panacea of different health problems and restoration of grasslands.

Keywords: Bioactive compounds, fodder grass, medicinal, nutritional

INTRODUCTION

Ecologically versatile grass species are found across ecotones, grasslands, and moist habitats of tropical India (Dey et al., 2024). Though use of grasses as wildlife fodder is commonly observed but they also have diverse applications as remedies to fight against health problems and as an alternate food source during adverse situations (Gebashe et al., 2019). *Alloteropsis cimicina* is one such understudied member of family Poaceae that plays a vital role in sustaining herbivorous wildlife by serving as a natural fodder source during lean seasons. Its tender shoots and leaves are highly palatable (Behera et al., 2025) and provide essential nutrients to grazing animals, contributing significantly to the trophic balance of forest ecosystems. Beyond its ecological role, *A. cimicina* also holds socio-economic importance as a traditional ‘famine food,’ in rural and tribal communities, the grains or flour derived from this grass are consumed during periods of food scarcity (Shah et al., 2019), reflecting its adaptability and nutritional value. Traditionally, the plant has been employed in indigenous healthcare practices for treating gastrointestinal ailments and as a folk remedy for maintaining hyperglycemia (Lohar and Arora, 2019). Thus, it becomes important to study the phytochemistry and radical-scavenging properties of such understudied but common grasses that can be helpful in developing plant-based therapeutics for conditions like Diabetes mellitus. Understanding its dual function as both a survival food and a promising medicinal grass would not only be essential for promoting its conservation and sustainable utilization but also its inclusion in fighting modern world diseases and managing climate-resilient ecosystems.

METHODOLOGY

Whole plants of *Alloteropsis cimicina* were collected from Puri district, Odisha, India (Figure 1). The species was taxonomically identified by the authors following Behera et al. (2025). The collected plants were thoroughly washed under running tap water to remove surface impurities and air-dried. The dried powder of collected grass was used for extraction using the Soxhlet apparatus with three solvents (n-hexane, ethanol, and water) for subsequent experimental analyses (Jena et al., 2025). Qualitative

phytochemical screening for the detection of secondary metabolites and Thin Layer Chromatography (TLC)-based antioxidant assays was conducted following standard protocols (Kumar et al., 2013; Pattnaik and Bhatnagar, 2023; Jena et al., 2025).



Figure 1: Plant parts of *Alloteropsis cimicina*

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Alloteropsis ciminica* revealed that solvent polarity significantly influenced metabolite extraction. Non-polar fractions showed no detectable compounds. Polar solvents, however, effectively extracted bioactive compounds (Table 1; Figure 2-4). The ethanol extract contained tannins, saponins, and reducing sugars, whereas the aqueous extract showed the presence of tannins, saponins, alkaloids, and reducing sugars. This suggests that the bioactive components of *A. ciminica* are primarily polar in nature. These metabolites contributed towards the potential antioxidant efficacy of the species. The thin-layer chromatography (TLC) based 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay confirmed the evidence by showing antioxidant activity in the aqueous extract (Table 2; Figure 5). The ethyl acetate: methanol: water system produced three distinct spots (R_f 0.809, 0.936, and 0.984), the chloroform: ethyl acetate: formic acid system showed two spots (R_f 0.916 and 0.983), while the n-hexane: petroleum ether: ethanol system exhibited fewer active components, with spots at R_f 0.4 and 0.75 and a streak from 0–0.25. These findings demonstrated that *A. ciminica* contain diverse range of polar antioxidant compounds with notable free radical scavenging potential.

Table 1: Qualitative phytochemical analysis of *A. ciminica*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin and Reducing sugars
	Aqueous	Tannin, Saponin, Alkaloid and Reducing sugars



Figure 2: Phytochemical analysis of *A. ciminica* using n-hexane extract



Figure 3: Phytochemical analysis of *A. ciminica* using ethanolic extract



Figure 4: Phytochemical analysis of *A. ciminica* using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *A. cimicina* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.809	0.936	0.984	-
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.916	0.983	-	-
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.4	0.75	-	0 – 0.25

(Rf: Retention factor)

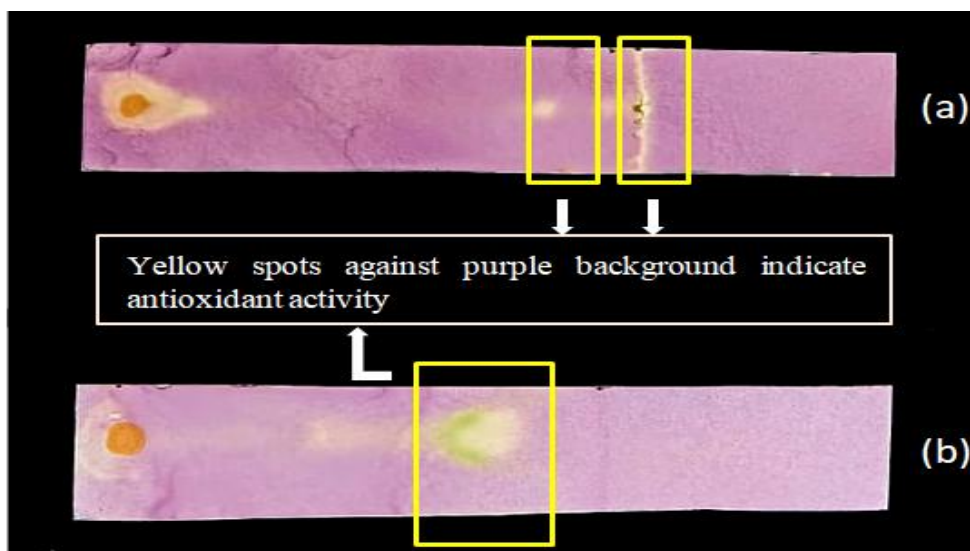


Figure 5: Antioxidant activity of *Alloteropsis cimicina* using (a) Ethyl acetate: Methanol: Water and (b) n-Hexane: Petroleum ether: Ethanol

Multiple ethnobotanical surveys across India and neighboring regions recorded *A. cimicina* both as a supplementary and seasonal food (used as flour or boiled like rice) and as a folk remedy (Shah et al., 2019). Reported traditional uses include treatments for diabetes and digestive complaints like flatulence and indigestion (Lohar and Arora, 2019). A combined study of LC–MS profiling with bioassays (Nischitha and Shivanna, 2021)

reported several putative compounds in methanolic extract but still, evidential scientific data on the species with deeper insights remains scarce.

CONCLUSION

Present study showed that *Alloteropsis cimicina* is a rich source of polar phytochemicals with notable antioxidant potential. Ethanol and aqueous extracts exhibited diverse bioactive compounds, with the aqueous extract showing the highest radical scavenging activity in TLC-DPPH assay. These findings suggest that *A. cimicina* could serve as a promising natural source of antioxidants and secondary metabolites of pharmacological relevance and a nutraceutical fodder grass. Further research on its bioactive compound isolation, mechanism of action, and potential product development could enhance its application in both ecological restoration and herbal formulation sectors.

REFERENCES

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Dey R, Sharma SB and Thakkar MG. (2024). Maximising ecological value and assessing land suitability for sustainable grassland management in Asia's largest tropical grassland, Western India. Scientific Reports. 14(1): 13658.
- Gebashe F, Aremu AO, Finnie JF and Staden JV. (2019). Grasses in South African traditional medicine: A review of their biological activities and phytochemical content. South African Journal of Botany. 122: 301-329.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. Journal of Biodiversity and Conservation. 9(2): 87-107.

- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Lohar M and Arora A. (2019). Quantitative ethno-medicinal studies of staple foods used by tribals of Southern Rajasthan (India). *International Journal of Pharmacy and Biological Sciences*. 9(1): 908-915.
- Nischitha R and Shivanna MB. (2021). Metabolite fingerprinting, in vitro antimicrobial and antioxidantactivities and in-silico docking in *Alloteropsis cimicina* and its endophytic fungus *Penicillium pinophilum*. *Molecular Biology Reports*. 8: 4021–4037.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Shah H, Lohar M, Arora A and Kapoor C. (2019). Ethno-functional food studies of non-commercial fruits used by Tribals of southern Rajasthan India. *Journal of Pharmacognosy and Phytochemistry*. 8(3): 4450-4452.

Chapter 7

Medicinal and nutraceutical values of *Eragrostis ciliaris* (L.) R.Br.: a wild grass of India

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ABSTRACT

Eragrostis ciliaris, a wild grass commonly found along roadsides has paleotropical distribution. Present study evaluated its medicinal and nutraceutical values through phytochemical screening and antioxidant activity. Results revealed that ethanol and aqueous extracts showed tannins, saponins, flavonoids, and reducing sugars. Antioxidant activity revealed diverse radical-scavenging compounds with varying R_f values. The findings highlight *E. ciliaris* as both an ecologically valuable fodder species and a source of natural antioxidants. However, research on its phytochemistry and pharmacological properties remains limited, warranting further studies to explore its therapeutic applications and ecological significance in India.

Keywords: Antioxidant potential, fodder species, secondary metabolites

INTRODUCTION

Grasses form the green foundation of terrestrial ecosystems, covering nearly one-third of Earth's land surface (Stevens, 2018). They stabilize soil

with dense fibrous roots, prevent erosion, and enhance water infiltration, thus maintaining watershed health. As primary producers, grasses convert sunlight into biomass that sustains vast herbivore populations and, in turn, higher trophic levels (Kazama et al., 2021). Their rapid growth and adaptability make them crucial in restoring degraded lands and maintaining ecosystem resilience under climate stress (Ojija, 2024). Grasses also sequester significant carbon below ground, mitigating greenhouse gas buildup. In open landscapes they regulate nutrient cycling and microclimates (Bai and Cotrufo, 2022). *Eragrostis ciliaris* is a widely distributed paleotropical grass (Poaceae), occurring across the Old-World tropics and subtropics and often naturalized in disturbed habitats such as roadsides, degraded pastures, and seasonally dry plains. It is an annual to short-lived perennial adapted to semi-arid and seasonally dry tropical biomes (POWO, 2025). While it is a commonly occurring grass, the palatability is still considered mild both as a wildlife and livestock fodder (Behera et al., 2025). The family Poaceae, one of the largest and most ecologically significant plant families, encompasses a vast diversity of grass species that contribute not only to global primary productivity but also to human and animal well-being. Beyond their ecological and economic importance, many grasses are now recognized for their phytochemical richness and medicinal potential (Gebashe et al, 2020; Singh and Patel, 2024). In this context, *Eragrostis ciliaris* (Figure 1), a small yet resilient grass species, represents an underexplored member of Poaceae deserving scientific attention. Present study was therefore carried out to profile its phytoconstituents and antioxidant activity that can provide the base for future researches based on plant-based drug development and quality control.

METHODOLOGY

Plant parts of *Eragrostis ciliaris* were collected from Khordha district, Odisha, India, and identified by the authors based on published literature (Behera et al., 2025). After thorough washing with running tap water to remove dust, the plant material was cut into small pieces. Soxhlet extraction was then performed using n-hexane, ethanol, and aqueous solvents (Jena et al., 2025). The extracts underwent qualitative phytochemical analysis to

detect secondary metabolites and TLC (Thin Layer Chromatography) based antioxidant analysis following standard methods (Kumar et al., 2013; Pattnaik and Bhatnagar, 2023; Jena et al., 2025).

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Eragrostis ciliaris* revealed that the distribution of secondary metabolites varied with solvent polarity (Table 1). The non-polar n-hexane extract showed no detectable bioactive compounds, indicating a limited presence of lipophilic metabolites. In contrast, ethanolic and aqueous extract displayed a richer phytochemical composition, with tannins, saponins, and reducing sugars identified in both, while flavonoids were exclusive to the aqueous extract. The presence of flavonoids and tannins suggests potential antioxidant and anti-inflammatory activities, as these compounds are known to act as free radical scavengers and metal ion chelators. The TLC-based DPPH (2,2-diphenyl-1-picrylhydrazyl) assay of aqueous extract was performed to confirm the antioxidant potential of *E. ciliaris* (Table 2). Notably, (Ethyl acetate: Methanol: Water) and (Chloroform: Ethyl acetate: Formic acid) systems produced two spots at R_f (0.666, 0.95) and (0.241, 0.983) respectively. While, R_f 0.793 along with a streak (0.238 – 0.507) was observed in the n-hexane: petroleum ether: ethanol system (Figure 2). These observations highlighted the presence of multiple antioxidant-active components in *E. ciliaris* implying the its potential radical-scavenging activity due to presence of diverse array of secondary metabolites which can again help in protection against cell damage and oxidative stress.

Table 1: Qualitative phytochemical analysis of *E. ciliaris*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin and Reducing sugars
	Aqueous	Tannin, Saponin, Flavonoid and Reducing sugars

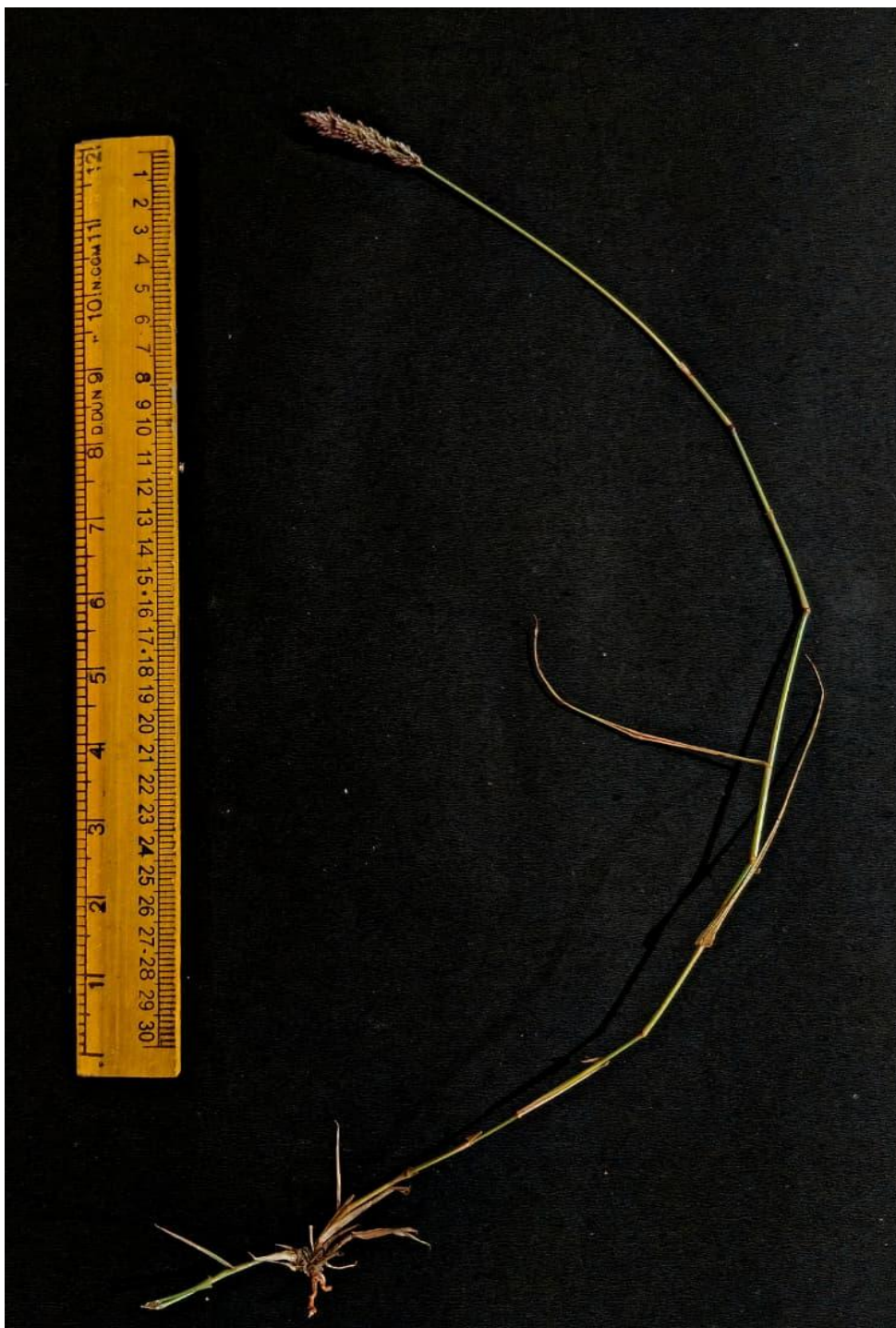


Figure 1: Whole plant of *Eragrostis ciliaris*

Table 2: TLC-based DPPH analysis of whole plant extract of *E. ciliaris* using different mobile phases

	Mobile Phases	Rf value of Spots		
		S1	S2	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.666	0.95	-
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.241	0.983	-
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.793	-	0.238 — 0.507

(Rf: Retention factor)

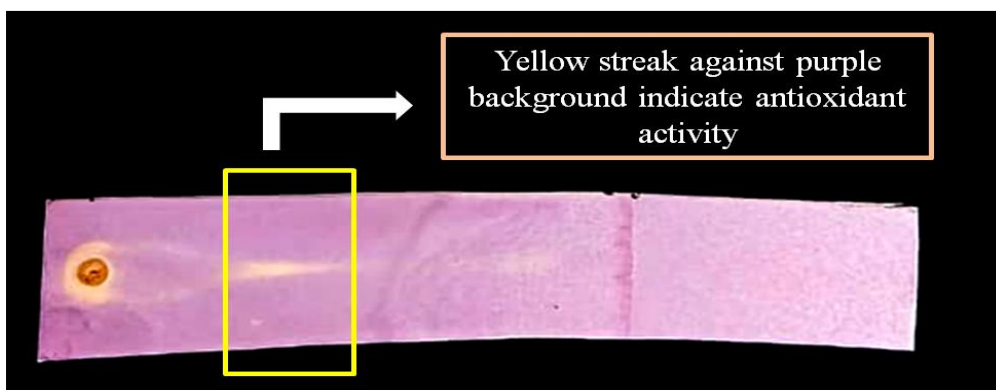


Figure 2: TLC-DPPH assay showing streaking in *E. ciliaris*

CONCLUSION

Current study revealed that *Eragrostis ciliaris* contains a diverse array of polar phytochemicals, with the aqueous extract emerging as the richest source of bioactive metabolites such as tannins, saponins, flavonoids, and reducing sugars. The TLC-DPPH assay further substantiated the plant's antioxidant potential, as different solvent systems exhibited distinct Rf values and streaking patterns, indicating the presence of multiple radical-scavenging compounds. These results suggest that the aqueous extract of *E. ciliaris* possesses significant antioxidant activity and may serve as a promising candidate for the development of natural therapeutics and plant-

based formulations. However, research on this grass species remains limited. Comprehensive studies exploring its phytochemical and pharmacological profiles are essential to fully elucidate its bioactive potential, while future investigations may also shed light on its ecological significance, forage value, and practical applications in sustainable resource management.

REFERENCES

- Bai Y and Cotrufo MF. (2022). Grassland soil carbon sequestration: Current understanding, challenges, and solutions. *Science*. 377: 603-608.
- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Gebashe F, Aremu AO, Gruz J, Finnie JF and Staden JV. (2020). Phytochemical profiles and antioxidant activity of grasses used in South African Traditional Medicine. *Plants (Basel)*. 9(3): 371.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Kazama T, Urabe J, Yamamichi M, Tokita K, Yin X, Katano I, Doi H, Yoshida T and Jr NGH. (2021). A unified framework for herbivore-to-producer biomass ratio reveals the relative influence of four ecological factors. *Communications Biology*. 4(1): 49.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.

- Ojija F. (2024). Perennial grasses: natural allies for soil health and biodiversity, climate change mitigation, and invasive plant management. *Grass Research*. 4: e020.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical Analysis and Bio Evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Singh SK and Patel S. (2024). Therapeutic Phytoconstituents-I. In: Pooja D and Kulhari H. (eds) *Nanotechnology Based Delivery of Phytoconstituents and Cosmeceuticals*. Springer, Singapore.
- Stevens CJ. (2018). Recent advances in understanding grasslands. *F1000Research*. 7(F1000): 1363.

Chapter 8

Roots of resilience: phytochemical and antioxidant perspectives on *Digitaria longiflora* (Retz.) Pers.

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ABSTRACT

Grasses are not merely background vegetation but they also shape ecosystems, sustain wildlife, and sometimes hide untapped medicinal potential. *Digitaria longiflora*, a resilient member of the Poaceae family, thrives across diverse and challenging habitats, offering both forage for herbivores and a window into bioactive chemistry. In this study, polar extracts of the plant revealed a rich array of secondary metabolites, including tannins, saponins, and reducing sugars, while non-polar fractions were largely inert. Qualitative antioxidant profiling uncovered multiple radical-scavenging compounds, reflected in distinct Rf values and streaking patterns, suggesting a complex phytochemical mosaic. Beyond supporting biodiversity and soil health, its bioactive constituents point toward potential applications in natural therapeutics. Expanding research on this overlooked grass could bridge conservation, forage science, and phytomedicine, demonstrating the hidden value of native flora in sustaining both ecosystems and human health.

Keywords: Photochemistry, natural therapeutics, wildlife forage

INTRODUCTION

The family Poaceae, one of the largest and most ecologically significant families of flowering plants, encompasses a remarkable diversity of grass species that sustain both ecosystems and economies worldwide (Linder et al., 2018). Members of this family not only serve as primary producers and soil stabilizers but are also increasingly recognized for their phytochemical richness and antioxidant potential, owing to the presence of bioactive compounds such as phenolics, flavonoids, tannins, and saponins (Gebashe et al., 2020). Among them, the genus *Digitaria* includes several ecologically resilient grasses that thrive across tropical and subtropical landscapes. Species such as *Digitaria radicata* and *Digitaria sanguinalis* are widely recognized for their adaptability to a broad range of soil types (Minoji and Sakai, 2024), including those with low fertility, while *Digitaria longiflora* shares similar ecological traits within the genus. *D. longiflora*, the Indian Crab grass is an annual or perennial grass found along forest fringes, wastelands, and open fields, holds ecological importance as a native fodder species contributing to the trophic dynamics of grassland ecosystems (POWO, 2025). Its extensive root system aids in soil conservation, while its tender shoots provide wildlife forage during dry periods. Despite its abundance, *D. longiflora* remains underexplored for its phytochemical and antioxidant potential, which may parallel the bioactive profiles observed in other Poaceae members. Understanding its ecological value, biochemical composition, and adaptive physiology can provide new insights into grass-based conservation strategies and plant-derived therapeutics from native flora.

METHODOLOGY

Whole plants of *Digitaria longiflora* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by authors followed by published book on regional flora (Saxena and Brahmam, 1996). Whole plant was thoroughly washed. Further, they were cut into small pieces and extraction (n-hexane, ethanol and aqueous) was carried out using Soxhlet for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant

analysis was done using standard methods (Kumar et al., 2013; Pattnaik and Bhatnagar, 2023; Jena et al., 2025).



Figure 1: Whole plant of *Digitaria longiflora*

RESULTS AND DISCUSSION

The qualitative phytochemical analysis of *Digitaria longiflora* revealed that the occurrence of secondary metabolites is strongly influenced by solvent polarity. While the non-polar n-hexane extract showed no detectable phytoconstituents, both ethanolic and aqueous extracts exhibited the presence of tannins, saponins, and reducing sugars, indicating that the plant is a rich source of polar bioactive compounds (Table 1; Figures 2–4). These metabolites are widely recognized for their antioxidant, antimicrobial, and metabolic-regulatory activities, which may contribute to the ecological adaptability of *D. longiflora* across diverse habitats. The TLC-based DPPH assay further confirmed the antioxidant efficacy of the aqueous extract through multiple R_f values and streaking patterns observed across different solvent systems (Table 2; Figure 5). In the ethyl acetate : methanol : water system, four distinct spots (R_f = 0.333, 0.416, 0.65, 0.7) and a streak (R_f = 0.4–0.916) indicated the presence of a wide range of polar antioxidant compounds. The chloroform: ethyl acetate: formic acid system revealed two spots (R_f = 0.938, 0.984) with a streak extending from 0 to 0.338, while the n-hexane: petroleum ether: ethanol system exhibited one prominent spot (R_f = 0.833) and a streak (0 to 0.35). These results highlighted the diverse composition of radical-scavenging metabolites in *D. longiflora*, suggesting synergistic antioxidant mechanism that could be further studied to test its efficacy in reducing cell damage and oxidative stress.

Table 1: Qualitative phytochemical analysis of *D. longiflora*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin and Reducing sugars
	Aqueous	Tannin, Saponin, and Reducing sugars



Figure 2: Phytochemical analysis of *D. longiflora* using n-hexane extract



Figure 3: Phytochemical analysis of *D. longiflora* using ethanolic extract

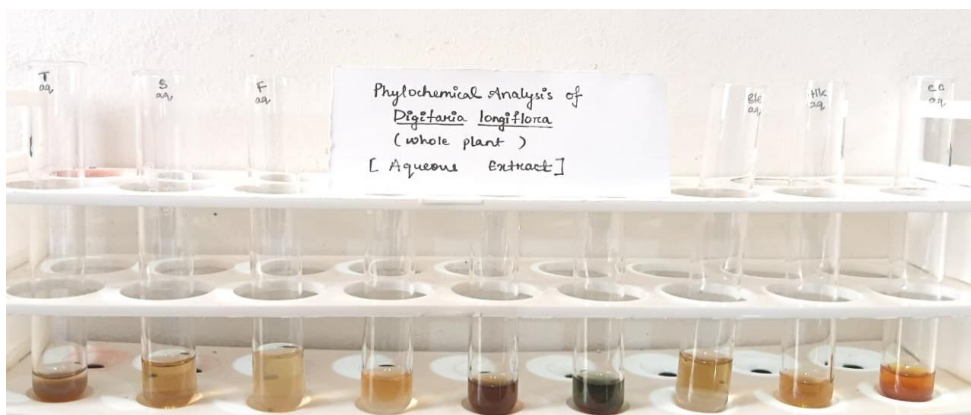


Figure 4: Phytochemical analysis of *D. longiflora* using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *D. longiflora* using different mobile phases

	Mobile Phases	Rf value of Spots				
		S1	S2	S3	S4	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.333	0.416	0.65	0.7	0.4 – 0.916
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.938	0.984	-	-	0 – 0.338
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.833	-	-	-	0 – 0.35

(Rf: Retention factor)

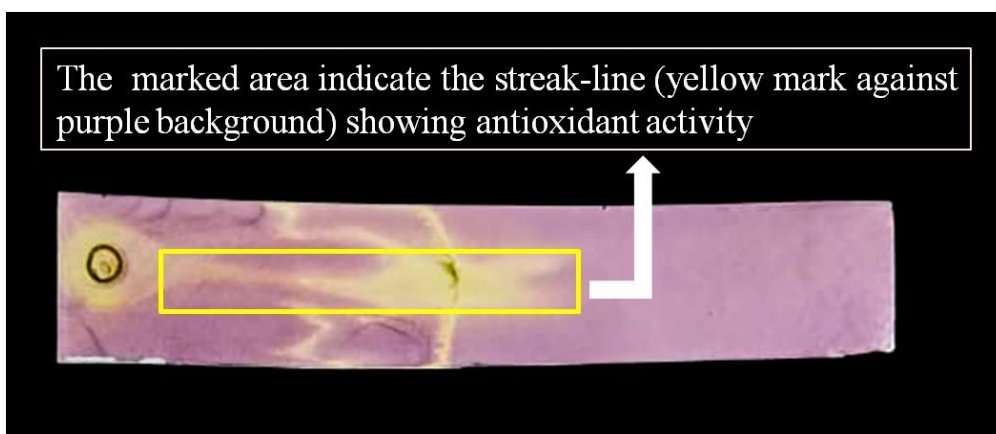


Figure 5: TLC based DPPH analysis using Ethyl acetate: Methanol: Water

CONCLUSION

The given study highlighted *Digitaria longiflora* as a promising grass species with notable phytochemical diversity and antioxidant potential. The dominance of polar metabolites such as tannins, saponins, and reducing sugars, along with multiple antioxidant-active spots in TLC-DPPH analysis, indicates a complex mixture of bioactive compounds contributing to its oxidative defense. Given its ecological resilience and abundance, *D. longiflora* represents an underexplored grass species with dual ecological and pharmacological significance. Further exploration through quantitative

assays, compound isolation, and in vivo evaluation could reveal its potential for natural therapeutics and sustainable ecological applications.

REFERENCES

- Digitaria longiflora* (Retz.) Pers. Plants of the world online (POWO). 2025. Royal Botanic Gardens, Kew.
- Gebashe F, Aremu AO, Gruz J, Finnie JF and Staden JV. (2020) Phytochemical profiles and antioxidant activity of grasses used in South African traditional medicine. *Plants*. 9(3): 371.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. *International Journal of Pharmaceutical Sciences Review and Research*. 18(1): 126-132.
- Linder HP, Lehmann CER, Archibald S, Osborne CP and Richardson DM. (2018). Global grass (Poaceae) success underpinned by traits facilitating colonization, persistence and habitat transformation. *Biological reviews of the Cambridge Philosophical Society*. 93(2):1125-1144.
- Minoji K and Sakai TA. (2024). Chromosome-scale genome assembly of Timorese crabgrass (*Digitaria radicata*): a useful genomic resource for the Poaceae. *G3*. 14(12): jkae242.
- Pattnaik M and Bhatnagar S. (2023). Phytochemical analysis and bio evaluation of *Terminalia racemosa* bark. *World Journal of Pharmaceutical Research*. 13(2): 674-680.
- Saxena HO and Brahmam M. (1996). The Flora of Orissa, Volume 4. Regional Research Laboratory, Bhubaneswar, Odisha & Orissa Forest Development Corporation Ltd., Bhubaneswar, Odisha, India.

Wai CS. (2015). Turf characteristics of native grasses *Digitaria longiflora* & *Ischaemum ciliare*. Research Technical Note Urban Greenery Series. RTN-02: 1-5.

Chapter 9

Antioxidant potential and secondary metabolites of *Polytrias indica* (Houtt.) Veldkamp (Poaceae): an understudied grass of India

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ABSTRACT

The genus *Polystrias* is of ecological and medicinal importance. Present study examined a lesser-known species *Polystrias indica*, of family Poaceae. As per contemporary situation, screening of new therapeutic agents and biodiversity conservation is an important task. Keeping this in view, qualitative phytochemical analysis and antioxidant activity of *Polystrias indica* was analyzed. Results indicated that only polar extracts showed availability of diverse bioactive compounds and multiple radical-scavenging spots across different solvent systems of aqueous extract. The results demonstrated the presence of diverse antioxidant compounds in *P. indica*, validating its viability with other members of the family and highlighting its potential for pharmacological and plant-based drug formulations. Its bioactive compounds and antioxidant activity make it a suitable fodder grass which could be useful in wildlife habitat management.

Keywords: Bioactive compounds, grass, fodder, medicinal

INTRODUCTION

Grasses are not only the foundation of global food security but also a largely untapped reservoir of pharmacologically active compounds (Gebashe et al., 2020). Beyond their agronomic significance, many grass species synthesize diverse classes of secondary metabolites including flavonoids, phenolic acids, alkaloids, terpenoids, and saponins that exhibit potent antioxidant, antimicrobial, anti-inflammatory, and anticancer activities (Kumar and Pandey, 2017). The wide adaptability of grasses to varied ecological niches promotes the development of unique phytochemicals as part of their defense systems, making them promising sources for drug discovery (Chihomvu et al., 2024). *Polytrias indica*, commonly known as Indian Polytrias or Java grass, belongs to the Poaceae family and is one of the few recognized species within the genus *Polytrias*. Members of this genus are tropical grasses predominantly distributed across South and Southeast Asia, extending to Africa and the Pacific islands. The genus *Polytrias* is closely allied to *Panicum* and *Brachiaria*, sharing several morphological and ecological traits (Washburn et al., 2015) such as resilience to drought, and adaptability to nutrient-poor soils. *P. indica* thrives in open grasslands, roadsides, and wastelands, contributing to soil stabilization and acting as a valuable forage resource for herbivorous with a moderate palatability (Behera et al., 2025). Beyond its ecological role, phytochemical investigations in related grasses have revealed the presence of bioactive constituents (Auwalayah et al., 2025). However, despite its wide distribution and ecological importance, *P. indica* remains underexplored in terms of photochemistry and pharmacological potential. The present study aims to investigate its secondary metabolites and antioxidant activity, thereby providing scientific insights into its role as a multipurpose grass with both ecological and pharmacological relevance.

METHODOLOGY

Whole plants of *Polytrias indica* were collected from Puri district, Odisha state, India (Figure 1). The plant species was identified by authors (Behera et al., 2025). Extraction (n-Hexane, Ethanol and Aqueous), qualitative

phytochemical analysis and antioxidant activity was carried out using standard methods (Jena et al., 2025; Roy and Devi, 2025).

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Polystrias indica* revealed that non-polar extracts did not show any detectable bioactive compounds, indicating the absence of significant non-polar metabolites. In contrast, polar solvents were effective in extracting secondary metabolites. Both ethanol and aqueous extracts contained tannins, saponins, and reducing sugars (Table 1). The antioxidant potential of the aqueous extract was evaluated using Thin Layer Chromatography (TLC)-based 2,2-Diphenyl-1-picrylhydrazyl (DPPH) assay. Multiple radical-scavenging spots were observed across different mobile phase systems. The ethyl acetate: methanol: water system produced a prominent spot at R_f 0.984 with streaking from 0 to 0.369, while the chloroform: ethyl acetate: formic acid system showed a spot at R_f 0.984 with a streak range of 0–0.218. The n-hexane: petroleum ether: ethanol system displayed a spot at R_f 0.833 with a streak from 0–0.367 (Table 2). These results indicated the presence of diverse antioxidant compounds in the aqueous extract of *P. indica*, with variable polarities contributing to its radical-scavenging activity.

Table 1: Qualitative phytochemical analysis of *P. indica*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin and Reducing sugars
	Aqueous	Tannin, Saponin, and Reducing sugars



Figure 1: Plant parts of *Polystrias indica*

Table 2: TLC-based DPPH analysis of whole plant extract of *P. indica* using different mobile phases

	Mobile Phases	Rf value of Spots	
		S1	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.984	0 – 0.369
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.984	0 – 0.218
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	0.833	0 – 0.367

(Rf: Retention factor)

Recently Roy and Devi, (2025) documented the medicinal, pharmacological and fodder values of *Sporobolus diandrus*, *Chloris barbata*, *Paspalum scrobiculatum*, *Dactyloctenium aegyptium*, *Setaria pumila*, *Digitaria ciliaris*, *Dinebra chinensis*, *Echinochloa colona* and *Urochloa distachyos*. Very less documentation is available on grass species and their medicinal values.

CONCLUSION

Present study concludes that *Polystrias indica* is rich in polar bioactive compounds. TLC-DPPH assays confirmed the presence of multiple antioxidant constituents with varying polarities, demonstrating significant radical-scavenging potential. These findings validate its potential for being the reservoir for a diverse range of constituents that remains unexplored. Present study recommends that there is a need of work in pharmacological and ecological restoration works.

REFERENCES

- Auwaliyah F, Rizqi HD, Purnomo AS and Fatmawati S. (2019). Antioxidant and antibacterial activities of *Ischaemum indicum* leaves extracted using different solvents. Malaysian Journal of Fundamental and Applied Sciences. 15(3): 436-40.
- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Chihomvu P, Ganesan A, Gibbons S, Woollard K and Hayes MA. (2024). Phytochemicals in drug discovery-A confluence of tradition and innovation. International Journal of Molecular Sciences. 25(16): 8792.
- Gebashe F, Aremu AO, Gruz J, Finnie JF and Van Staden J. (2020). Phytochemical Profiles and Antioxidant Activity of Grasses Used in South African Traditional Medicine. Plants. 9(3): 371.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry,

antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.

Kumar S and Pandey AK. Chemistry and biological activities of flavonoids: an overview. (2013). *Scientific World Journal*. 2013: 162750.

Roy BC and Devi RS. (2025). *Grasses & Sedges of India: Food, Medicinal & Ecological Aspects*. Ambika Prasad Research Foundation, Odisha, India.

Washburn JD, Schnable JC, Davidse G and Pires JC. (2015). Phylogeny and photosynthesis of the grass tribe Paniceae. *American Journal of Botany*. 102(9):1493-505.

Chapter 10

Ecological, phytochemical and antioxidant potential of *Rottboellia cochinchinensis* (Lour.) Clayton

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ABSTRACT

Grasses play a vital role in ecosystems by stabilizing soil, preventing erosion, and providing forage for herbivores. *Rottboellia cochinchinensis*, an attractive perennial grass, contributes significantly to these functions while supporting biodiversity and habitat regeneration. Beyond its ecological importance, it has traditional medicinal uses attributed to bioactive compounds. Present study evaluated its secondary metabolites and antioxidant activity. Results revealed that non-polar extracts showed no detectable compounds, whereas ethanol and aqueous extracts contained tannins, saponins, flavonoids, phenols, and reducing sugars, with the aqueous extract being richest. Antioxidant analysis revealed multiple radical-scavenging spots across different solvent systems, indicating diverse antioxidant constituents. These results support its traditional medicinal use, ecological and pharmacological significance.

Keywords: Bioactive compounds, traditional medicine, fodder grass, wildlife management

INTRODUCTION

Rottboellia cochinchinensis (Figure 1) is an annual upland grass of the Poaceae family known as the Itchgrass, that often go unnoticed along tropical and subtropical landscapes, yet it quietly anchors ecosystems in remarkable ways (Bundit et al., 2022). Its dense network of roots and rhizomes binds soil, prevents erosion, and stabilizes degraded lands, while its persistent ground cover enhances the resilience of grasslands and forest edges against both natural and human-induced disturbances (Fadun et al., 2017). While it has been documented to have a low palatability among wildlife (Behera et al., 2025), it supports local biodiversity and maintains ecosystem productivity. In disturbed habitats, this hardy grass can be found in plenty while in row crops, pastures and roadsides, it gets competitive (Allawan, 2021). Beyond its ecological contributions, *R. cochinchinensis* harbors hidden pharmacological treasures. Traditional knowledge highlights its medicinal potential (Guevara and Garcia, 2018), which indicates towards the presence of bioactive compounds in its various parts that can imply towards its potential antioxidant, anti-inflammatory, and antimicrobial effects. Exploration of these properties can validate it as a promising candidate for natural product exploration, yet surprisingly little scientific work has systematically investigated its phytochemistry and therapeutic potential while largely, it is regarded as a weed due to its allelopathic potential (Bundit et al., 2022). This study aims to bridge that gap by exploring the phytochemical profile and antioxidant activity of *R. cochinchinensis* using qualitative screening and Thin Layer Chromatography (TLC)-based 2, 2-Diphenyl-1-picrylhydrazyl (DPPH) assay. By unraveling its bioactive constituents and radical-scavenging potential, the research provides a scientific foundation for its traditional medicinal uses, while highlighting the ecological and pharmacological significance of this resilient, yet often overlooked, grass.

METHODOLOGY

Whole plants of *Rottboellia cochinchinensis* were collected from Puri district, Odisha, India (Figure 1). The plant species was identified using published literature (Behera et al., 2025). Soxhlet method extraction (n-

Hexane, Ethanol and Aqueous) was carried out for further experimental works (Jena et al., 2025). Qualitative phytochemical analysis for detection of secondary metabolites and Thin Layer Chromatography (TLC) based antioxidant analysis was done using standard methods (Kumar et al., 2013; Jena et al., 2025; Roy and Devi, 2025).



Figure 1: Plant parts of *Rottboellia cochinchinensis*

RESULTS AND DISCUSSION

The phytochemical screening of *Rotboellia cochinchinensis* showed that solvent polarity plays a key role in extracting metabolites (Table 1; Figure 2–4). The non-polar extracts did not contain any detectable bioactive compounds. In contrast, polar solvents effectively extracted secondary metabolites. The ethanol extract contained tannins, saponins, phenols, and reducing sugars, while the aqueous extract was richer, showing tannins, saponins, flavonoids, phenols, and reducing sugars (Table 1, Figure 2-4). The antioxidant activity of the aqueous extract was tested using TLC combined with DPPH assay. Multiple radical-scavenging spots were observed across different solvent systems (Table 2). The ethyl acetate: methanol: water system showed spots at R_f 0.65 and 0.793, the chloroform: ethyl acetate: formic acid system produced spots at R_f 0.278, 0.360, and 0.983, and the n-hexane: petroleum ether: ethanol system exhibited a streak ranging from 0.25 to 0.85 (Figure 5). These results indicate that *R. cochinchinensis* contains diverse antioxidant compounds, mainly polar in nature, which can scavenge free radicals effectively.

Table 1: Qualitative phytochemical analysis of *R. cochinchinensis*

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds are not detected.
	Ethanol	Tannin, Saponin, Phenol and Reducing sugars
	Aqueous	Tannin, Saponin, Flavonoids, Phenol and Reducing sugars



Figure 2: Phytochemical analysis of *R. cochinchinensis* using n-hexane extract

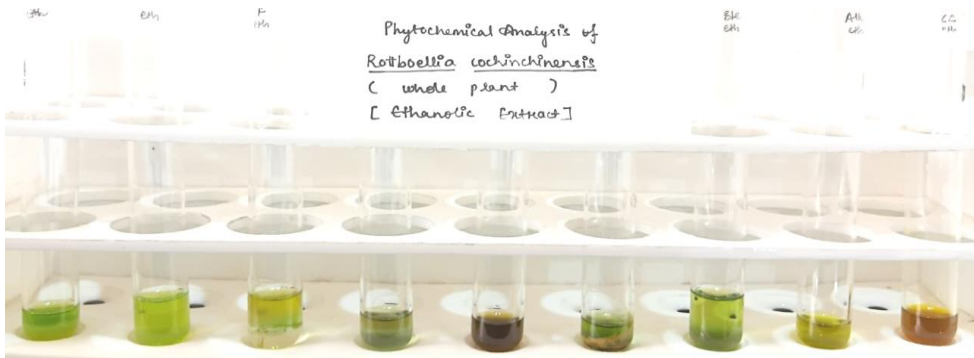


Figure 3: Phytochemical analysis of *R. cochinchinensis* using ethanolic extract

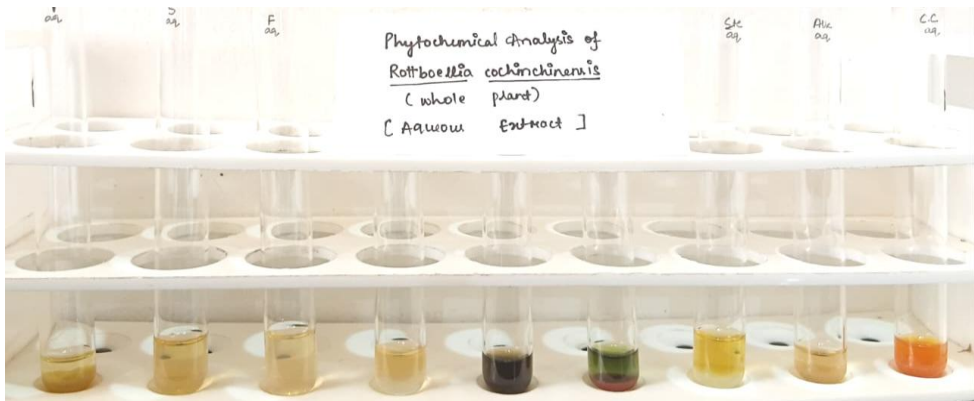


Figure 4: Phytochemical analysis of *R. cochinchinensis* using aqueous extract

Table 2: TLC-based DPPH analysis of whole plant extract of *R. cochinchinensis* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.65	0.793	-	-
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.278	0.360	0.983	
	n-Hexane: Petroleum ether: Ethanol (10: 10: 80)	-	-	-	0.25 – 0.85

(Rf: Retention factor)

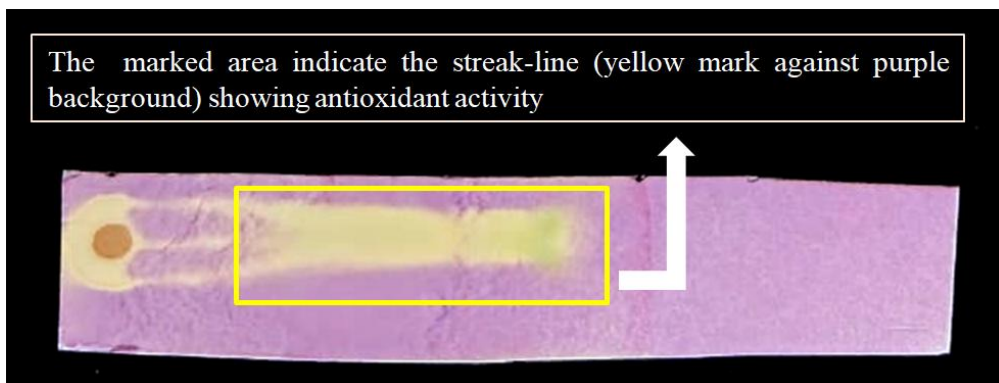


Figure 5: TLC based DPPH analysis using (n-Hexane: Petroleum ether: Ethanol)

Traditional medicinal values of *R. cochinchinensis* have been documented by various scientific surveys. Its leaves have been reviewed to have purgative functions and leaves along with roots and stems to be edible in nature (Fadun et al., 2017). The plant has also been surveyed to be ingested as infusion by Matigsalug Tribe of Philippines in treatment of vomiting (Guevara and Garcia, 2018).

CONCLUSION

Present study highlights *Rottboellia cochinchinensis* as more than a mere grass but a reservoir of bioactive potential. Rich in polar metabolites such as tannins, saponins, flavonoids, phenols, and reducing sugars, the species exhibited notable antioxidant capacity. These findings validate its traditional medicinal use and suggest promise for development of natural drugs. Beyond pharmacological value, it also plays an ecological role in soil stabilization, biodiversity support, and forage provision. Future explorations aimed at isolating and characterizing its active compounds may uncover new possibilities for both human health and environmental resilience.

REFERENCES

Allawan JG. Grasses and Legumes at the Banana Field in the Panabo City, Philippines. (2021). International Journal of Research and Scientific Innovation. 8(8): 125-33.

- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Bundit A, Meksawat S, Ullah H, Datta A and Pornprom T. (2022). Allelopathic Plants: 33. *Rottboellia cochinchinensis* (Lour.) WD Clayton. Allelopathy Journal. 56(2): 133-148.
- Fadun OO, Soaga JA, Adedokun MO and Oladoye AO. (2017). Ethnomedicinal values and diversity of understory plants in two forest plantations in Abeokuta, Ogun State, Nigeria. African Journal of Agriculture Technology and Environment. 6(1): 53-66.
- Guevara CP and Garcia MM. (2018). Ethnobotanical practices of Matigsalug tribe on medicinal plants at barangay Baganihan, Marilog district, Davao City. Journal of Complementary and Alternative Medical Research. 6(3): 1-4.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. Journal of Biodiversity and Conservation. 9(2): 87-107.
- Kumar S, Jyotirmayee K and Sarangi M. (2013). Thin Layer Chromatography: a tool of biotechnology for isolation of bioactive compounds from medicinal plants. International Journal of Pharmaceutical Sciences Review and Research. 18(1): 126-132.
- Roy BC and Devi RS. (2025). Grasses & Sedges of India: Food, Medicinal & Ecological Aspects. Ambika Prasad Research Foundation, Odisha, India.

Chapter 11

Nutraceutical aspects of *Sporobolus diandrus* (Retz.) P.Beauv.: a palatable grass of herbivores

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ABSTRACT

Grasslands are vital for supporting wildlife, protecting soil, and maintaining ecological balance. *Sporobolus diandrus* (smut grass), though often overlooked, is an ecologically valuable species that is abundantly found in moist places, roadsides, and grasslands. Present study explored its phytochemical and nutritional properties through qualitative metabolite screening to understand its role in wildlife management and grassland restoration. The plant contained carbohydrates, proteins, and reducing sugars, indicating good nutritional value for herbivores. Hydroethanolic extracts showed the presence of tannins and flavonoids, suggesting medicinal properties and a potential natural defense mechanism of the grass. These findings showed that *S. diandrus* is both nutritionally and ecologically important, making it a promising species for grassland restoration and wildlife sustenance.

Keywords: Biodiversity, phytochemicals, wildlife fodder

INTRODUCTION

Every living and non-living component of the earth plays a vital role in maintaining ecological balance and sustaining life (Raven and Wackernagel, 2020). However, over the past century, unchecked human greed and rapid exploitation of natural resources have caused severe imbalances across ecosystems, from forests and oceans to deserts, mountains, grasslands, and even agricultural landscapes (Adebayo, 2019). Among them, grasslands are one of the most productive and ecologically significant ecosystems on planet Earth, providing essential services such as carbon sequestration, soil stabilization, and habitat for countless species (Stevens, 2018). These ecosystems are the lifeline for herbivores, both wild and domesticated, and play an important role in maintaining biodiversity. Therefore, it can be easily observed that among all living components, grasslands and wildlife share one of the most intricate and indispensable relationships. Unfortunately, rapid urbanization, deforestation, and the introduction of invasive species have severely degraded native grasslands (Zhao et al., 2022), threatening not only plant diversity but also the wildlife that depends on them. These widespread anthropogenic activities, combined with a loss of traditional ecological knowledge, have weakened our ability to conserve this delicate bond (Khosravi and Escobedo, 2025). In this context, understanding and documenting the diversity, palatability, biochemical composition, and ecological relationships of fodder grasses in relation to other abiotic factors have become critically important. Recognizing this need, the team at Ambika Prasad Research Foundation (APRF) undertook an initiative to document and study the grasses of Odisha, as well as their ecological and nutritional significance. As part of this effort, the authors selected a wild fodder grass *Sporobolus diandrus* (Figure 1-2), commonly known as ‘smut grass’, to evaluate its qualitative metabolite profile. The aim is to draw attention towards the nutraceutical potential of this wild fodder grass and promote its use in grassland restoration for improved wildlife management. The authors affirm, “Better understanding of grasses leads to better understanding of wildlife and ultimately, a better understanding of climate.”

METHODOLOGY

The experimental plant sample (Figure 1) was identified by the authors, followed by the published flora book (Behera et al., 2025). The identified plant samples were then collected and kept in a cloth bag tagged with the botanical name for further use. The collected grass parts were first washed thoroughly under running tap water to remove soil particles, debris, and other surface contaminants. The clean plant material was then cut into small pieces (Figure 3) and air-dried in a well-ventilated, shaded area. Drying was continued until a constant weight was achieved, ensuring complete removal of moisture content. Fully dried plant material was pulverized into fine powder using a mechanical grinder. The powdered samples were stored in a clean, airtight container to prevent exposure to moisture and contamination. A known quantity of the powdered material was placed in a thimble and subjected to Soxhlet extraction (Jena et al., 2025) using solvents of increasing polarity, i.e. acetone, hydro-ethanol (7:3) and methanol. The obtained extracts were filtered and concentrated by air drying at room temperature to remove excess solvent. The dried crude extracts were carefully weighed and stored in sterile, labelled vials under refrigerated conditions (4°C) until further use for phytochemical analyses.

Detection of primary metabolites: Qualitative analysis of primary metabolites was carried out by the standard method (Jena et al., 2025).

Test for carbohydrates: About 1 ml of extract is mixed with 2-5 drops of Fehling's solution A and B and kept in the water bath for 30 minutes. A reducing sugar reacts with Fehling's reagent in an alkaline medium to form an orange-to-red precipitate. The appearance of this orange or red precipitate indicates the presence of carbohydrates.

Test for protein: About 1 ml of extract is mixed with 2-5 drops of Millon's reagent and kept in the water bath for 30 minutes. The pink coloration indicates the presence of protein.

Test for starch: To 1 ml of extract, 2-3 drops of concentrated HCl are added and heated for 1-2 minutes. NaOH, following Benedict's reagent, is added to this solution and kept in the water bath. The change in coloration from bluish-green to red-orange indicates the presence of starch.



Figure 1: Whole plant of *Sporobolus diandrus*



Figure 2: Collection of *Sporobolus diandrus* (a) and inflorescence (b)



Figure 3: Collected plant parts of *Sporobolus diandrus*

Test for sucrose: 1 ml of extract is mixed with 2-3 drops of iodine solution. The appearance of a blue-black colour indicates the presence of sucrose.

Test for lipid: 1 ml of extract is mixed with 2-5 drops of Sudan-III. The appearance of pink droplets indicates the presence of lipids.

Test for amino acids: 1 ml of extract is mixed with 5 drops of Ninhydrin reagent and kept in the water bath for 30 minutes. Ninhydrin is a powerful oxidizing agent to give a purple-coloured product (diketohydrin) termed Rhuemann's purple. The appearance of purple or bluish colour indicates the presence of amino acids.

Detection of secondary metabolites: Qualitative analysis of secondary metabolites was performed by the method followed by Hossain et al., (2025).

Test for tannin: 1 ml of plant extract is mixed with 4-5 drops of 10% lead acetate solution. The formation of a light-yellow precipitate confirms the presence of tannins.

Test for saponin: 1 ml of plant extract is mixed with 1 ml of distilled water, and after vigorous shaking, the formation of a stable, persistent froth confirms the presence of saponins.

Test for flavonoids: To 2 ml of plant extract, a few drops of dilute sodium hydroxide (NaOH) are added. The appearance of an intense yellow colour indicates the presence of flavonoids. Subsequent addition of 4-5 drops of dilute sulphuric acid causes the colour to fade, further confirming the presence of flavonoids.

Test for terpenoids: A mixture of 1 ml of plant extract and 2 ml of chloroform is prepared, and an equal volume of concentrated sulphuric acid is added. The appearance of a reddish-brown coloration at the interface confirms the presence of terpenoids.

Test for phenolic compounds: 1 ml of plant extract is treated with 5 drops of 1% ferric chloride solution, resulting in the formation of a bluish-black coloration, which indicates the presence of phenolic compounds.

Test for reducing sugars: 1 ml of plant extract is added with 3 drops of Fehling's solution A and B, and kept in water bath for a few minutes. The formation of an orange-red precipitate confirms the presence of reducing sugars.

Test for steroids: 1 ml of plant extract is mixed with 2 ml of chloroform, followed by the addition of 2 ml of concentrated sulphuric acid. The resulting

formation of two distinct phases, characterized by an upper red layer and a lower yellow layer with green fluorescence, confirms the presence of steroids.

Test for alkaloids: 1 ml of plant extract is mixed with 3-4 drops of Dragendorff's reagent and kept in water bath for a few minutes. The formation of an orange-red precipitate confirms the presence of alkaloids.

RESULTS AND DISCUSSION

The study aimed to understand the availability of primary and secondary metabolites in *Sporobolus diandrus* to link with grassland and wildlife management.



Figure 4: Bull grazing *S. diandrus* along with grass species

In this view, the results revealed that the whole plant extracts of *S. diandrus* detected the presence of protein and carbohydrates (Table 1) along with reducing sugars, which validate its nutritional values. Hence, the plant parts may provide nutrition to the livestock (Figure 4) and wildlife (Figure 5). The qualitative analysis of secondary metabolites revealed that, hydroethanolic extract showed the presence of tannin and flavonoids, which indicate its medicinal properties (Table 2). The availability of these biotic compounds in *S. diandrus* may be useful as a therapeutic agent for herbivores (Roy and Devi, 2025). Other detected bioactive compounds indicated that the grass has defense mechanism against abiotic and biotic stresses (Fan et al., 2020). Therefore, the plant can thrive in different habitats that can be useful in grassland restoration.



Figure 5: Spotted deer grazing *S. diandrus* along with *Setaria pumila*

Table 1: Qualitative phytochemical analysis of *S. diandrus* for the detection of primary metabolites

Polarity	Extract	Detected primary metabolites
Non-Polar  Polar	Acetone	Carbohydrates only
	Hydroethanolic	Protein and carbohydrates
	Methanol	No tested compounds were detected

Table 2: Qualitative phytochemical analysis of *S. diandrus* for the detection of secondary metabolites

Polarity	Extract	Detected secondary metabolites
Non-Polar  Polar	Acetone	Saponin and Reducing sugars
	Hydroethanolic	Tannin, Flavonoids, and Reducing sugars
	Methanol	Tannin and Saponin

CONCLUSION

Grasslands are among the most productive and ecologically important ecosystems. They not only serve as primary producers but also offer nutritional and medicinal values to the grazing herbivores. Present study on *Sporobolus diandrus* is based on the qualitative screening of primary and

secondary metabolites. The presence of carbohydrates, proteins, and reducing sugars shows its nutritional contribution to grazing herbivores and livestock. The presence of secondary metabolites like tannins and flavonoids in the hydroethanolic extract reveals its therapeutic potential and adaptive biochemical defense mechanisms. These bioactive compounds not only support the plant's resilience under varied ecological conditions but also suggest its possible roles in animal health and stress tolerance. Continued exploration into its phytochemical diversity and ecological interactions can deepen our understanding of how native grasses like *S. diandrus* can bridge the gap between conservation biology and sustainable grassland management.

REFERENCES

- Adebayo O. (2019). Loss of biodiversity: the burgeoning threat to human health. *Annals of Ibadan Postgraduate Medicine*. 17(1): 1-3.
- Behera SC, Mishra S, Mishra AK and Kumar S. (2025). Grasses of Chandaka-Dampara Wildlife Sanctuary. Ambika Prasad Research Foundation, Odisha, India.
- Fan J, Zhang W, Amombo E, Hu L, Kjorven JO and Chen L. (2020). Mechanisms of Environmental Stress Tolerance in Turfgrass. *Agronomy*. 10(4): 522.
- Hossain E, Roy BC, Jena N and Kumar S. (2025). Plants and Secondary Metabolites, Volume IV. Ambika Prasad Research Foundation, Odisha, India.
- Jena N, Vimala, Singh B, Patra A, Sharma BP, Hossain E and Kumar S. (2025). Methods for ethnobotanical data collection, phytochemistry, antioxidant, anthelmintic, and antimicrobial activities for pharmacological evaluation of medicinal plants. *Journal of Biodiversity and Conservation*. 9(2): 87-107.
- Khosravi M A and Escobedo F. (2025). The role of traditional ecological knowledge and ecosystem quality in managing ecosystem services. *Science Reports*. 15(1): 31510.

- Raven P and Wackernagel M. (2020). Maintaining biodiversity will define our long-term success. *Plant Diversity*. 42(4): 211-220.
- Roy BC and Devi RS. (2025). *Grass & Sedges of India: Food, Medicinal & Ecological Aspects*. Ambika Prasad Research Foundation, Odisha, India.
- Stevens CJ. Recent advances in understanding grasslands. (2018). *F1000 Research*. 7: 1363.
- Zhao X, Feng Y, Xu K, Cao M, Hu S, Yang Q, Liu X, Ma Q, Hu T, Kelly M, Guo Q and Su Y. (2022). Canopy structure: an intermediate factor regulating grassland diversity-function relationships under human disturbances. *Fundamental Research*. 3(2): 179-187.

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Grasses are the green threads
that weave life together

Nourishing wildlife ! Sustaining livestock ! Supporting human survival



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