

Chapter 11

Nutraceutical aspects of *Sporobolus diandrus* (Retz.)

P.Beauv.: a palatable grass of herbivores

Sanjeet Kumar¹, Sugimani Marndi¹, Sweta Mishra¹, Neeraj² and
Sumitra Jethy^{1*}

¹Ambika Prasad Research Foundation, Odisha, India

²Department of Botany, Government Post Graduate College, Sector 1,
Panchkula, Haryana, India

*Email-Id: sumitrajethy19@gmail.com

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.

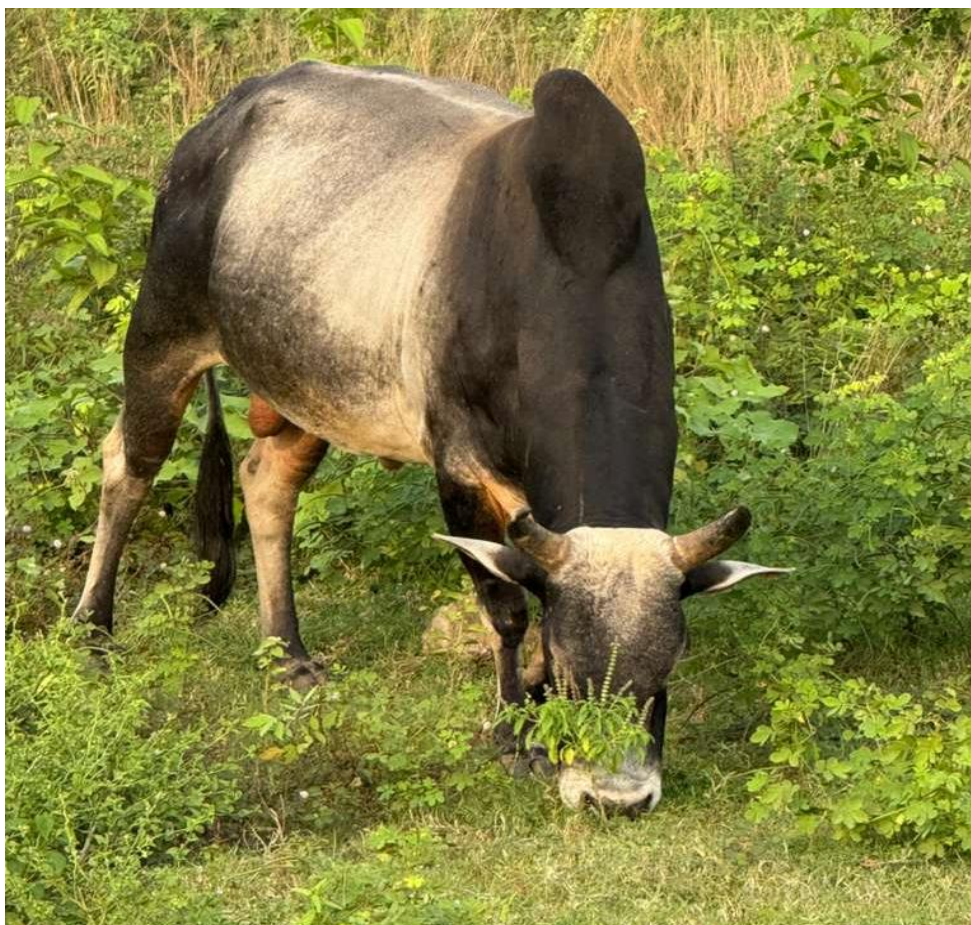


Figure 4: Bull grazing *S. diandrus* along with grass species

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.