

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*

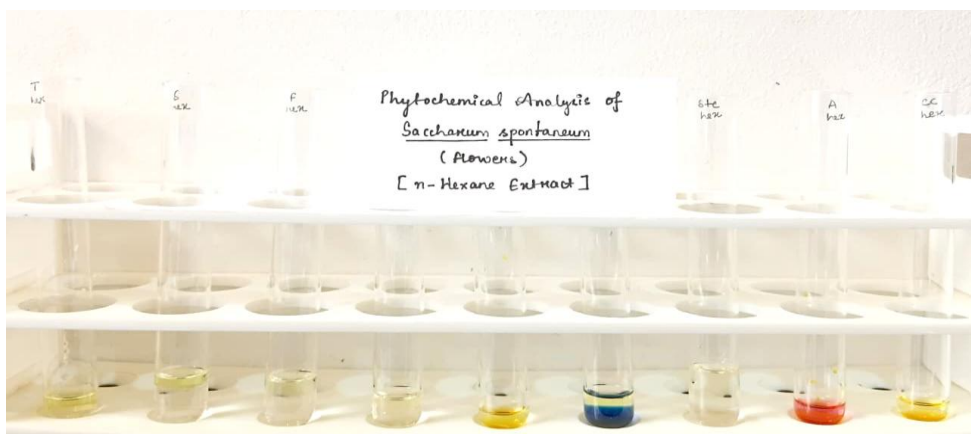


Figure 2: Phytochemical analysis of *S. spontaneum* using n-hexane extract

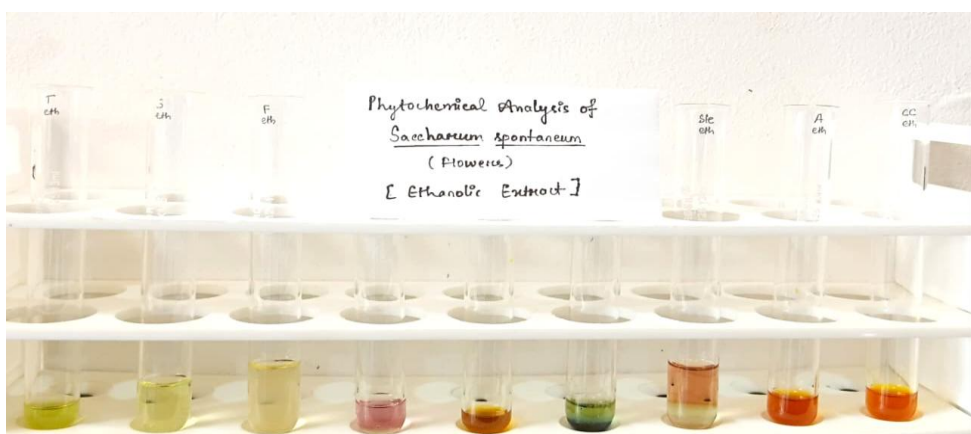


Figure 3: Phytochemical analysis of *S. spontaneum* using ethanolic extract



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)

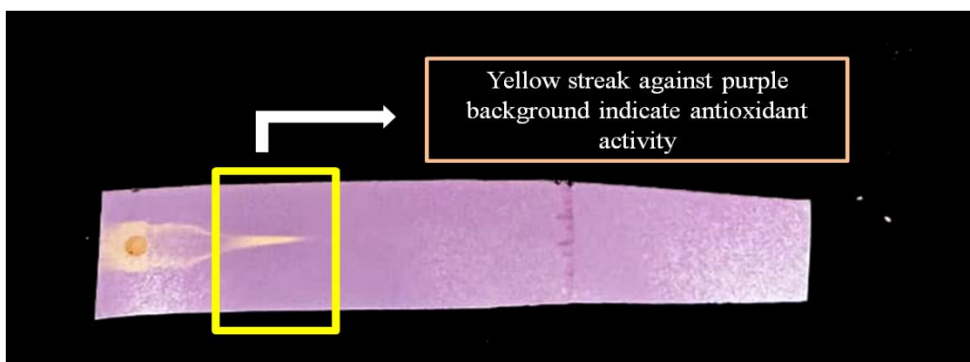


Figure 5: Antioxidant activity of *Saccharum spontaneum*

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.
- 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.