Chapter 11

Unexplored sedge of India: fodder, antioxidant and medicinal potential of *Cyperus iria* L. (Cyperaceae)

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Abstract: *Cyperus iria*, a widely distributed yet underexplored sedge of India. In the contemporary situation, screening of fodder plants and medicinal agents is an important task. Therefore, qualitative phytochemical screening revealed the presence of key metabolites, with tannins and reducing sugars detected in aqueous extracts and carbohydrates & starch as primary metabolites, suggesting nutritional and therapeutic value. Thin layer chromatography (TLC)-based DPPH assay demonstrated notable antioxidant activity, particularly in aqueous fractions with distinct Rf values, indicating the presence of free radical–scavenging compounds. These findings highlight *C. iria* as a valuable natural resource with scope for further bioassay-guided studies to isolate and characterize its active phytoconstituents for sustainable ethnomedicinal and nutraceutical applications.

Keywords: Sedge, phytochemical screening, primary metabolites, secondary metabolites, TLC-DPPH assay, antioxidant activity, fodder potential, medicinal plant, nutraceuticals

Introduction

Cyperus iria L. (Cyperaceae), commonly known as rice flat sedge, is a fast-growing annual species widely distributed in India (Figure 1-2). Traditionally regarded as a weed of paddy fields, this sedge plays an important ecological role in soil stabilization and provides a readily available source of fodder for livestock in rural landscapes (Jiang et al., 2018). Despite its abundance and adaptability, *C. iria* remains largely underexplored for its biochemical and pharmacological attributes. Recent studies on members of the genus *Cyperus* have revealed the presence of diverse primary and secondary metabolites with antioxidant, antimicrobial, and medicinal properties (Motmainna et al., 2021). However, scientific information on the phytochemistry and bioactivity of *C. iria* is scarce, creating opportunities to assess its nutraceutical and therapeutic potential. The plant's adaptability

to diverse habitats and its rapid biomass production further enhances its significance as a sustainable resource for fodder and medicinal applications. In this context, the present study aims to investigate the primary and secondary metabolites of *C. iria* through qualitative phytochemical screening and thin layer chromatography (TLC)-based DPPH antioxidant analysis. By documenting its biochemical profile and antioxidant activity, present work seeks to highlight the species' potential for use in animal nutrition, herbal medicine, and future bioactive compounds discovery.

Materials and methods

Sample collection: *Cyperus iria* was collected from Cuttack, Odisha, India (Figure 1). Plant specimen is identified by authors followed by published literature (Saxena and Brahmam, 1996).

Phytochemical screening: Successive extractions were performed using n-hexane, ethanol, and distilled water. Standard protocols were followed for detecting the primary and secondary metabolites (Jena et al., 2025).

Antioxidant activity: For the detection of antioxidant potential, DPPH assay was carried out (Bhatnagar et al., 2013). n-Hexane, acetone, ethanol, and aqueous extracts were run in three mobile phases given below (Eloff et al., 2008). The TLC plates were air dried and then the chromatograms were sprayed with 0.2 % DPPH in methanol as an indicator. The presence of antioxidant compounds was detected by yellow spots against a purple background.

a) Ethyl acetate: Methanol: Water (40: 5.4:4) [EMW] (Polar neutral)

b) Chloroform: Ethyl acetate: Formic acid (5:4:1) [CEF] (Intermediate polarity/acidic)

c) n-Hexane: Petroleum ether: Ethanol (90:10:1) [BEA] (Non-polar/Basic)

Results and discussion

Qualitative phytochemical screening of *Cyperus iria* revealed a selective distribution of primary and secondary metabolites across different solvent extracts. Among the secondary metabolites, the aqueous extract exhibited the presence of tannins and reducing sugars, whereas the ethanolic extract showed only reducing sugars (Table 1). No secondary metabolites were detected in the non-polar (n-hexane) extract, indicating that the major bioactive compounds of *C. iria* are more soluble in polar solvents. Similarly, the analysis of primary metabolites demonstrated that carbohydrates were present in the ethanolic

extract, while both carbohydrates and starch were detected in the aqueous extract (Table 2), suggesting the nutritional significance of this sedge as a potential fodder resource. TLC-based DPPH antioxidant assay further confirmed the antioxidant potential of *C. iria*. Aqueous extracts displayed distinct spots with measurable Rf values under different mobile phases (Table 3). The highest retention factor (Rf 0.983) was observed in the chloroform:ethyl acetate: formic acid system, accompanied by a streak ranging from 0 to 0.344, indicating the presence of compounds with strong free radical–scavenging activity. The ethyl acetate: methanol: water system also produced a significant spot with an Rf value of 0.758, while no detectable antioxidant compounds were observed in the n-hexane: petroleum ether: ethanol system. These findings suggest that antioxidant constituents are predominantly concentrated in the polar fractions of the plant.

Table 1: Qualitative phytochemical analysis of *C. iria* for detection of secondary metabolites

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

Table 2: Qualitative phytochemical analysis of *C. iria* for detection of primary metabolites

Polarity	Extract	Detected primary metabolites
Non-Polar  Polar	n-Hexane	All tested bioactive compounds were not detected.
	Ethanol	Only Carbohydrate
	Aqueous	Starch and Carbohydrate

The overall results highlight *C. iria* as a source of nutritionally relevant primary metabolites and bioactive secondary metabolites with notable antioxidant activity. The predominance of polar compounds underscores the importance of aqueous and ethanolic extractions for maximizing the recovery of active constituents. This phytochemical and antioxidant profile supports the traditional use of the plant as a fodder resource and

provides a scientific basis for its potential applications in natural antioxidant development and ethnomedicinal formulations.

Table 3: TLC-based DPPH analysis of *C. iria* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	Streak
Aqueous	Ethyl acetate: Methanol: Water (40:5.4:4)	0.758	-	-	-
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.983			0-0.344
	n-Hexane: Petroleum ether: Ethanol (90:10:1)	-	-	-	-

(Rf: Retention factor)



Figure 1: Dried plant sample of *C.iria* for experimental purpose



Figure 2: *Cyperus iria* in its wild habitat

Conclusion

Cyperus iria L. demonstrates significant nutritional and pharmacological potential, with polar extracts rich in primary metabolites such as carbohydrates and starch, as well as secondary metabolites including tannins and reducing sugars. The TLC-DPPH analysis confirmed its antioxidant activity, particularly in aqueous and ethanolic fractions, highlighting its ability to scavenge free radicals. These findings position *C. iria* as a valuable, underutilized sedge with applications in fodder production, natural antioxidant development, and potential medicinal use. Further studies involving bioassay-guided fractionation and isolation of active compounds could pave the way for its incorporation into sustainable nutraceutical and ethnomedicinal frameworks.

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