

Chapter 16

Nutritional, antioxidant, and pharmacological potential of *Fimbristylis sericea* R.Br. (Cyperaceae)

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Abstract: *Fimbristylis sericea* R.Br. (Cyperaceae), a coastal sedge with significant ecological importance, has been understudied for its nutritional and therapeutic benefits. Present study explored its primary and secondary metabolites and antioxidant activity using TLC-based DPPH (2,2-Diphenyl-1-picrylhydrazyl) assays. Key metabolites like tannins, saponins, phenols, proteins, and carbohydrates were detected in ethanol and aqueous extracts, whereas n-hexane extracts showed no bioactive compounds. The TLC-DPPH analysis revealed distinct antioxidant spots, indicating potent radical-scavenging properties. These results position *F. sericea* as a valuable source of natural antioxidants and a promising fodder sedge, with potential pharmaceutical applications.

Keywords: Bioactive compounds, Cyperaceae, therapeutic values

Introduction

The genus *Fimbristylis* (Cyperaceae) comprises of herbaceous sedges widely distributed in tropical and subtropical regions, occupying wetlands, sand dunes, and disturbed habitats (Sunil et al., 2016). Among them, *Fimbristylis sericea* R.Br., (Figure 1) thrives along coastal ecosystems, where it plays a critical role in soil stabilization and habitat restoration. Members of Cyperaceae have been reported to contain bioactive compounds with nutritional, antioxidant, and pharmacological properties along with ecological significance (Barrett, 2013; Taheri et al., 2021). However, scientific literature on the phytochemical and medicinal attributes of *F. sericea* remains scarce. Antioxidant-rich plants are gaining attention for their ability to neutralize free radicals, thereby reducing the risk of oxidative stress-related health problems (Kumar et al., 2017; Mallik et al., 2024; Chandrashekar et al., 2025). Investigating the phytochemical parameters and antioxidant activity of *F. sericea* can provide valuable insights into its potential as a natural source of therapeutic agents and nutraceuticals.



Figure 1: *Fimbristylis sericea* in its habitat

Materials and methods

F. sericea was collected from Cuttack, Odisha, India (Figure 2). Plant specimen was identified by authors followed by published literature (Saxena and Brahman, 1996). 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). 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: Distilled 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) [HPE] (Non-polar/Basic)



Figure 2: Plant parts of *F. sericea*

Results and discussion

The qualitative screening revealed that secondary metabolites such as tannins, saponins, phenols, and reducing sugars were abundant in ethanolic and aqueous extracts, whereas non-polar n-hexane extracts showed no detectable bioactive compounds (Table 1). Similarly, primary metabolites, including proteins and carbohydrates, were present only in ethanol and aqueous fractions (Table 2), indicating a higher polarity of nutritionally significant constituents. TLC-DPPH assays demonstrated prominent antioxidant activity in aqueous extracts, with distinct purple-to-yellow spots appearing across different mobile

phases (Table 3). The mobile phase Chloroform: Ethyl acetate: Formic acid (5:4:1) exhibited the highest Rf value (0.984), suggesting the presence of highly mobile antioxidant compounds (Figure 3).

Table 1: Qualitative phytochemical analysis for detection of secondary metabolites

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

Table 2: Qualitative phytochemical analysis for detection of primary metabolites

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

Table 3: TLC-based DPPH analysis of *F. sericea* using different mobile phases

	Mobile Phases	Rf value of Spots		
		S1	S2	Streak
Aqueous	Ethyl acetate: Methanol: Distilled water (40:5.4:4)	0.866	0.916	0.216 – 0.833
	Chloroform: Ethyl acetate: Formic acid (5: 4: 1)	0.984	-	0 – 0.333
	n-Hexane: Petroleum ether: Ethanol (90:10:1)	0.555	0.793	0.238 – 0.904

(Rf: Retention factor)

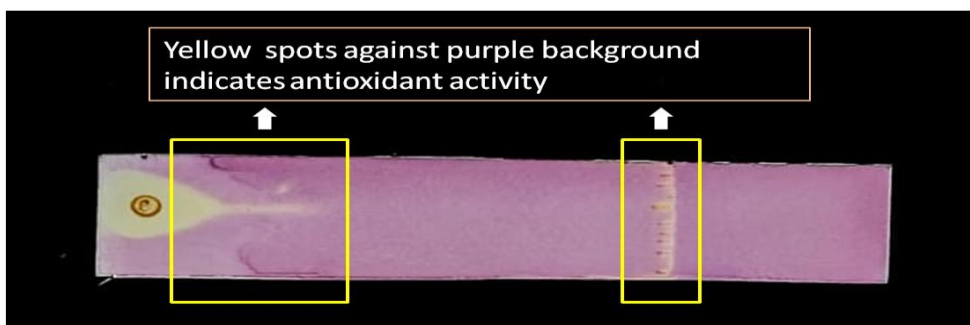


Figure 3: Antioxidant activity of *F. sericea* in Chloroform: Ethyl acetate: Formic acid system

The predominance of phenolic compounds, tannins, and saponins in ethanolic and aqueous extracts suggests that *F. sericea* contains metabolites with strong antioxidant and pharmacological potential. Phenolics and tannins are well-known for their free radical-scavenging capacity and ability to modulate oxidative stress pathways, while saponins contribute to anti-inflammatory and antimicrobial activities. The absence of metabolites in non-polar extracts indicates that the bioactive constituents of *F. sericea* are largely polar in nature, aligning with its aqueous habitat. The strong DPPH activity across multiple mobile phases further supports the presence of diverse antioxidant compounds. The high R_f value (0.984) in the chloroform-ethyl acetate-formic acid system points to the presence of low-polarity antioxidants, suggesting a complex phytochemical profile. Collectively, these findings provide the first phytochemical evidence of the antioxidant potential of *F. sericea*, supporting its use as a candidate for nutraceutical and pharmaceutical applications.

Conclusion

Present study reveals *Fimbristylis sericea* as a rich source of nutritionally significant primary metabolites and pharmacologically relevant secondary metabolites, particularly phenolics and tannins. The plant exhibits promising antioxidant activity, as evidenced by TLC-DPPH assays, indicating its potential role in preventing oxidative stress-related diseases. Further studies on compound isolation, structural characterization, and *in vivo* pharmacological validation are essential to fully exploit the therapeutic potential of this underutilized coastal sedge.

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