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Review Article

Cyperaceae as a source of novel antifungal agents: current evidence and future directions

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Abstract: Fungal infections are an increasing global health concern, further complicated by delayed diagnosis and the rapid emergence of antifungal resistance. This has demanded the exploration of alternative sources of antifungal agents, particularly from plants. The present review compiles and analyzes available literature on the antifungal potential of the family Cyperaceae, a widely distributed yet underexplored group of monocots. Evidence indicates that several species, especially within the genus *Cyperus*, exhibit significant antifungal activity against pathogens such as *Candida*, *Aspergillus*, *Fusarium* and *Penicillium*. Among them, *Cyperus rotundus* demonstrates broad-spectrum efficacy, supported by both crude extracts and isolated compounds including α-cyperone, β-sitosterol and α-amyrin. Studies consistently show that ethanolic extracts work better than aqueous extracts, highlighting the importance of non-polar phytoconstituents like terpenoids. However, the activity remains variable across species and target fungi, indicating the need for more systematic investigations. All things considered, Cyperaceae shows up as a promising but underexplored source of antifungal drugs with potential uses in treating the escalating problem of drug-resistant fungal infections.

Keywords: Anti-fungal agents, bioactive compounds, *Candida*, Cyperaceae, fungi, sedges

Introduction

Fungal infections are no longer just secondary concerns; they have become a serious and underestimated public health challenge (Neabore, 2024). From superficial skin infections to invasive systemic mycoses, fungi such as *Candida*, *Aspergillus* and *Fusarium* are increasingly affecting individuals, especially those with compromised immunity (Reddy et al., 2022). What makes this more concerning is how frequently these infections go undiagnosed until later stages, when treatment becomes difficult and mortality risk rises. The situation has only worsened in recent years, with fungal co-infections emerging alongside other diseases and within clinical settings (Shah et al., 2024). At the same time, the growing resistance to commonly used antifungal drugs, due to their prolonged use, is steadily reducing the effectiveness of available therapies (Logan et al., 2022). This creates a clear need to look beyond conventional antifungal agents and explore alternative sources. In this direction, plants offer a compelling possibility. They have always been part of traditional healing systems and are known to produce a wide range of bioactive compounds, often with fewer side effects and more complex modes of action (Wink, 2015). This diversity makes them an especially relevant fighter in tackling resistance, where single-target drugs tend to fail. Within this context, the family Cyperaceae (Plate 1) begins to stand out; even though it has not been explored as extensively as some other plant groups (Sharma et al., 2025). It is one of the largest monocot families, widely distributed across diverse habitats, particularly wetlands and tropical regions (Sharma and Devi, 2025). The genus *Cyperus*, which dominates this family, includes several species that have long been used in traditional medicine across Asia and other parts of the world (Roy and Devi, 2025). Among them, *Cyperus rotundus* is perhaps the most well-known, with documented uses in treating a variety of ailments (Taheri et al., 2021). Interesting part is that recent studies are starting to uncover the antifungal potential of these plants, through crude extracts, essential oils and isolated compounds (Langbang et al., 2025). While still scattered, these evidence points toward a consistent pattern: sedges possess bioactive constituents capable of inhibiting important fungal pathogens. This makes them worth a more focused and systematic investigation, not just from a phytochemical perspective but also in terms of their relevance in addressing the growing challenge of antifungal resistance.

Methodology

The present study is based on an extensive survey of published literature related to family Cyperaceae. Scientific databases, including Google Scholar, Scopus, PubMed and Web of Science, were consulted to retrieve peer-reviewed research articles, review papers, ethnobotanical surveys and pharmacological studies. Keywords including “Cyperaceae,” “phytoconstituents,” “antifungal resistance,” “fungal infections,” “ethnopharmacology”, “fungal diseases” and “sedges” were used to review relevant publications. Additionally, regional floras, theses, books and reports documenting traditional knowledge and distribution patterns were examined. Only studies containing verifiable scientific or ethnomedicinal data were considered. Information obtained was critically analyzed and systematically organized under thematic sections to ensure clarity and coherence (Kumar, 2025; Sahu et al., 2026).

Antifungal activity

The available research shows that Cyperaceae members possess notable but variable antifungal activity, largely influenced by extract type and phytochemical composition (Table 1). Across species, ethanolic extracts consistently perform better than aqueous extracts, indicating that the active compounds are predominantly non-polar, likely belonging to essential oils, terpenoids and sterol fractions (Adeniyi et al., 2014). Among the taxa, *Cyperus rotundus* emerges as the most potent, well-supported and well-documented species (Taheri et al., 2021), exhibiting broad-spectrum inhibition against multiple fungi, including high activity against *Aspergillus flavus* (Sabaly et al., 2024).

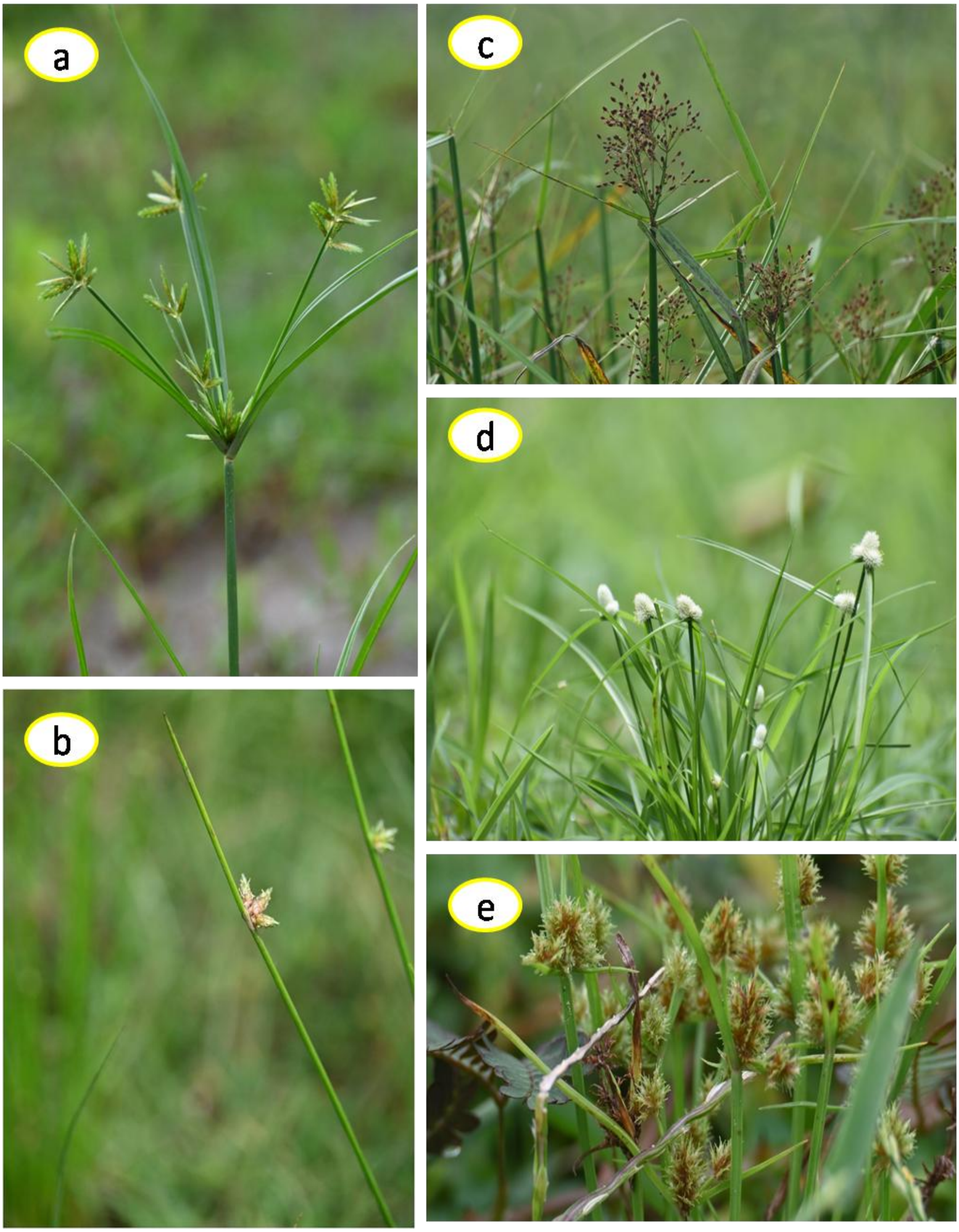

Plate 1: Members of Cyperaceae (a) *Cyperus compressus*, (b) *Schoenoplectiella juncoides,* (c) *Actinoscirpus grossus*, (d) *Cyperus dubius* var. *dubius* and (e) *Cyperus squarrosus*

Its efficacy is further validated at the compound level, with constituents such as α-cyperone, β-sitosterol and α-amyrin showing clear antifungal and anticandidal activities (Babiaka et al., 2025). In contrast, species like *Cyperus articulatus* and *Cyperus iria* display moderate to low or selective activity while *Lippia alba* showing complete inhibitory effects, suggesting species-specific variability (Table 1). The phytochemical diversity of Cyperaceae is directly associated with its antifungal activity; however, this activity varies among taxa and pathogens, emphasising the requirement of targeted research and focused compound isolation.

Table 1: Consolidated antifungal activity of reviewed Cyperaceae species

Species	Plant part / extract	Target fungi	Activity	Observation	Source(s)
Cyperus articulatus	Rhizome volatiles	*Aspergillus flavus*	75.08 - 78.11% inhibition	Moderate, dose-dependent inhibition	Sabaly et al., (2024)
Cyperus esculentus	Aqueous and ethanolic extracts	*A. fumigatus*, *Penicillium chrysogenum* (inactive against *A. niger*, *Candida albicans*)	1.00 - 6.13 cm	Ethanol extract more effective	Adeniyi et al., (2014)
Cyperus iria	Leaf volatiles	*Fusarium graminearum*	8.96% inhibition	Weak but significant volatile-mediated inhibition	Jiang et al., (2018)
Cyperus rotundus	Rhizome (essential oil: α-Cyperone);	*Candida krusei* and *Cryptococcus neoformans*	125 µg/mL (*C. krusei*)	Major antifungal constituent	Horn and Vediyappan, (2021)
	Whole plant extracts (aqueous, ethanolic)	*Aspergillus flavus*, *A. niger*, *A. fumigatus*, *Penicillium chrysogenum*, *C. albicans*	Up to 93.65% (*A. flavus*); zones: 0.88 - 9.38 cm	Broad-spectrum, strong antifungal potential	Sabaly et al., (2024)

	Isolated compounds (β-sitosterol, α-amyrin)	*Candida famata*, *C. albicans*	18 mm (*C. albicans)*, 19 mm (*C. famata)*; 250 mg/mL (MIC)	Confirmed anticandidal phytochemicals	Babiaka et al., (2025)
Lippia alba	Leaf volatiles	*A. flavus*	100% inhibition	Complete suppression at all doses	Sabaly et al., (2024)
Mariscus alternifolius	Aqueous and ethanolic extracts	*A. fumigatus*, *P. chrysogenum*	2.38 - 6.75 cm	Moderate activity; enhanced in ethanol	Adeniyi et al., (2014)

Research gaps

Despite emerging evidence of antifungal activity in Cyperaceae, studies remain fragmented and largely preliminary, with limited standardization in extraction methods, assay conditions and target organisms. Moreover, there is a lack of detailed mechanistic insights, *in vivo* validation and clinical relevance, particularly for isolated bioactive compounds, restricting their translational potential.

Future aspects

Future research should focus on systematic phytochemical profiling and bioassay-guided isolation of active compounds across diverse Cyperaceae species, particularly beyond well-studied taxa like *Cyperus rotundus*. Additionally, *in vivo* validation, exploring synergistic interactions with existing antifungal drugs and standardizing extraction and testing protocols will be crucial for translating these findings into viable therapeutic applications.

Conclusion

Recognized phytoconstituents from relatively well-documented species like *Cyperus rotundus*, support the promising antifungal potential of Cyperaceae. The reviewed pharmacological activities emphasize the chemical richness of bioactive compounds of sedges and are mostly linked to non-polar substances like terpenoids and essential oils with respect to their antifungal potential. But, there is still a lack of consistency and depth in the evidence, which varies between species and target fungus. Also, sedges are comparatively less explored like the other monocot families like Poaceae and Orchidaceae. To make the most out of the potential of Cyperaceae as a source of novel antifungal drugs, this field will need to be advanced by targeted, standardized and mechanism-focused research.

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