International Journal of Biology Research
www.biologyjournal.in
ISSN: 2455-6548
Received: 26-02-2026, Accepted: 29-03-2026, Published: 13-04-2026
Volume 11, Issue 2, 2026, Page No. 14-18

Assessment of macrofungal diversity and ecological functions in a managed campus ecosystem

Sahaya Mary[1*], Kavitha R S[2], Asha D R[1]
[1] Department of Botany, Teresian College, Mysuru, Karnataka, India
[2] Department of Zoology, Teresian College, Mysuru, Karnataka, India
Corresponding author: Sahaya Mary

Abstract
Macrofungi are essential components of terrestrial ecosystems, contributing significantly to nutrient cycling, decomposition, and symbiotic interactions. The present study was undertaken to document and identify macrofungal diversity within a semi-natural college campus ecosystem in Mysuru, India. Field surveys were conducted during the monsoon and post-monsoon seasons across diverse microhabitats, including lawns, garden soils, decaying wood, tree bases, and termite mounds. Specimens were collected, photographed in situ, and identified based on macromorphological and microscopic characteristics using standard taxonomic keys. The study recorded the occurrence of five ecologically important genera: Ganoderma, Scleroderma, *Leucocoprinus, Coprinellus disseminatus,* and *Termitomyces. Ganoderma* species were predominantly associated with decaying wood and functioned as white-rot decomposers. Scleroderma species exhibited ectomycorrhizal associations with tree roots, indicating their role in plant nutrition and soil health. *Leucocoprinus and Coprinellus disseminatus* were observed on organic-rich substrates, contributing to rapid decomposition and nutrient recycling. *Termitomyces* species were closely associated with termite mounds, reflecting their obligate symbiotic relationship and role in lignocellulosic degradation. The findings highlight that even managed campus environments can support diverse and functionally significant macrofungal communities. The seasonal occurrence of these fungi during periods of high humidity underscores the influence of environmental factors on fungal growth. This study emphasizes the ecological importance of macro fungi and the need for their continued documentation and conservation in semi-urban landscapes, while also recognizing their potential ecological, economic, and biotechnological significance.

Keywords: Macrofungi, *Ganoderma, Scleroderma, Leucocoprinus, Termitomyces*

Introduction

Macrofungi constitute an important yet often overlooked component of terrestrial biodiversity. They play a vital role in ecosystem functioning through processes such as decomposition of organic matter, nutrient cycling, soil formation, and the maintenance of ecological balance (Deacon, 2006; Mueller *et al*., 2004) [2, 6] . In addition, many macrofungi form symbiotic associations with plants, contributing to nutrient mobilization and overall ecosystem stability (Smith & Read, 2008) [10]. Despite their ecological significance, macrofungi remain underexplored, particularly in semi-urban and institutional landscapes (Lodge *et al*., 2004) [5]. Accurate identification and systematic documentation of macrofungi are essential for understanding biodiversity patterns, assessing ecosystem health, and supporting conservation strategies (Hawksworth, 2001) [3]. Furthermore, macrofungi hold considerable economic and medicinal potential, making their study valuable not only from an ecological perspective but also for sustainable resource utilization (Wasser, 2010) [11]. Macrofungi are vital components of terrestrial ecosystems, contributing significantly to organic matter decomposition, nutrient cycling, and ecosystem stability. Among them, genera such as Ganoderma, Scleroderma, *Leucocoprinus, Termitomyces,* and *Coprinellus* represent ecologically and economically important groups with diverse functional roles (Deacon, 2006; Mueller *et al*., 2004) [2, 6]. The genus *Ganoderma* comprises polypore fungi widely distributed in tropical and subtropical regions, commonly occurring on living trees, stumps, and decaying wood. These fungi function as white-rot decomposers capable of degrading lignin, cellulose, and hemicellulose, thereby playing a crucial role in carbon cycling. In addition, *Ganoderma* species are well known for their bioactive compounds and long-standing use in traditional medicine (Paterson, 2006) [8]. *Scleroderma*, commonly known as earthballs, represents a group of basidiomycetous fungi that are predominantly ectomycorrhizal. These fungi form mutualistic associations with the roots of woody plants, enhancing nutrient and water uptake while receiving carbohydrates from the host. They are widely distributed across forest soils, grasslands, plantations, and disturbed habitats, contributing significantly to soil health and ecosystem functioning (Smith & Read, 2008) [10].The genus *Leucocoprinus* includes saprotrophic fungi typically found on organic-rich substrates such as leaf litter, compost, and decaying plant material. These fungi play an important role in nutrient recycling and are commonly observed in tropical and subtropical environments. Their presence reflects the availability of organic matter and favourable microhabitat conditions (Kirk *et al*., 2008) [4]. *Termitomyces* species are unique macrofungi characterized by an obligate symbiotic association with termites of the family Termitidae. These fungi are cultivated within termite nests, where they facilitate the breakdown of lignocellulosic material into simpler compounds, thus contributing to nutrient cycling. Morphologically, they are distinguished by features such as large fruiting bodies and long pseudorhiza. Due to their ecological importance and edibility, *Termitomyces* species have gained considerable attention in mycological studies (Aanen *et al*., 2002) [1]. *Coprinellus disseminatus,* commonly known as the fairy inkcap, is a saprotrophic basidiomycete frequently found growing in dense clusters on decaying wood, stumps, and organic debris. It plays a significant role in the decomposition of lignocellulosic material and is often observed during humid conditions, especially after rainfall. Unlike many inkcaps, it exhibits limited deliquescence, making it an important species for studying fungal adaptation and ecological succession in decomposing substrates (Kirk *et al*., 2008; Nagy *et al*., 2013) [4, 7].

The present study focuses on the documentation and identification of these macrofungal taxa within a college campus. Academic campuses often function as semi-natural ecosystems with diverse vegetation, organic matter accumulation, and relatively minimal disturbance, providing suitable habitats for macrofungi (Lodge *et al*., 2004) [5]. Investigating macrofungal diversity in such environments not only enhances understanding of local biodiversity but also promotes ecological awareness and conservation within institutional landscapes.

Materials and Methods

Study Area

The present study was conducted within Teresian College campus and its surrounding localities in Mysuru, characterized by semi-natural and managed ecosystems. The campus comprises landscaped gardens, avenue trees, open lawns, shaded groves, and undisturbed soil patches with abundant leaf litter and decaying wood. The presence of both native and ornamental vegetation provides diverse substrates suitable for macrofungal growth, including wood-inhabiting, saprotrophic, and ectomycorrhizal fungi (Lodge *et al*., 2004; Mueller *et al*., 2004) [5, 6].

Organically enriched soils, regular irrigation, and the accumulation of plant litter create favourable conditions for saprotrophic fungi such as *Leucocoprinus* and *Coprinellus disseminatus,* particularly in areas rich in decomposing lignocellulosic material (Kirk *et al*., 2008) [4]. The occurrence of ectomycorrhizal fungi such as *Scleroderma* is supported by the presence of diverse woody plant species, which facilitate symbiotic associations in both managed and undisturbed habitats (Smith & Read, 2008) [10].

In addition, selected study sites included tree-lined patches, decomposing wood zones, and regions characterized by termite mounds in and around Mysuru, which provide suitable habitats for *Termitomyces* species due to their obligate symbiosis with termites (Aanen *et al*., 2002) [1]. Wood-decaying fungi such as Ganoderma were commonly observed on living trees, stumps, and fallen logs across the study area. The region experiences a tropical savanna climate with distinct wet and dry seasons. The average temperature ranges between 20°C and 32°C, with relative humidity often exceeding 70% during the monsoon season. These environmental conditions are highly conducive to the seasonal emergence and growth of macrofungi (Lodge *et al*., 2004) [5].

Field Survey and Collection

Field surveys were conducted during the monsoon and post-monsoon seasons, when macrofungal fruiting bodies are most abundant. Regular visits were made to different parts of the campus and surrounding areas, covering diverse microhabitats such as lawns, garden beds, tree bases, shaded groves, termite mounds, decaying logs, stumps, and leaf litter-rich zones. These habitats provided suitable conditions for the occurrence of macrofungi including *Ganoderma, Scleroderma, Leucocoprinus, Coprinellus disseminatus,* and *Termitomyces* (Lodge *et al*., 2004; Mueller *et al*., 2004) [5, 6]. Surveys were often conducted during early morning hours, particularly following rainfall, when the emergence of fungal fruiting bodies is at its peak. A random sampling approach was adopted to ensure comprehensive coverage of the study area. Fruiting bodies were observed in situ, occurring either singly or in groups, and detailed ecological data were recorded, including date and time of collection, substrate type, growth pattern, and surrounding vegetation (Kirk *et al*., 2008) [4].

Specimens of *Ganoderma* were located on tree trunks, stumps, and fallen logs, while *Scleroderma* species were observed emerging from soil surfaces in association with tree roots. *Leucocoprinus* and *Coprinellus disseminatus* were commonly found on organic-rich substrates such as leaf litter, compost, and decaying wood. *Termitomyces* species were specifically surveyed around termite mounds and adjoining soil, reflecting their obligate symbiotic association with termites (Aanen *et al*., 2002; Smith & Read, 2008) [10]. All specimens were photographed in their natural habitat prior to collection to document morphological characteristics, growth habit, and substrate association. Careful collection techniques were employed using sterile forceps or scalpels to avoid damage, especially for delicate forms such as *Leucocoprinus* and *Coprinellus disseminatus. In* the case of *Termitomyces*, special attention was given to excavating the entire fruiting body, including the long pseudorhiza. Collected samples were placed in labelled sterile containers or paper bags to minimize moisture accumulation and prevent contamination. Efforts were made to minimize disturbance to the natural habitat during collection, ensuring sustainable sampling practices (Lodge *et al*., 2004) [5].

Identification of Specimens

Collected specimens were identified based on a combination of macromorphological and microscopic characteristics following standard mycological keys and taxonomic literature (Kirk *et al*., 2008; Pegler, 1977) [4]. Macromorphological identification included detailed observation of features such as size, shape, colour, and texture of the basidiocarps. In *Ganoderma,* characters such as the nature of the basidiocarp (laccate or non-laccate), pore surface, presence or absence of a stipe, and host substrate were considered important diagnostic features (Paterson, 2006) [8]. For *Scleroderma,* identification was based on the shape and size of the fruiting body, colour and texture of the peridium, nature of the gleba, and the presence of surface cracks or scales (Smith & Read, 2008) [10]. In *Leucocoprinus,* distinguishing features included cap (pileus) and stipe morphology, colour and texture of the pileus, presence of free gills and annulus, and the fragile nature of the basidiocarp (Kirk *et al*., 2008) [4]. *Coprinellus disseminatus* was identified based on cap morphology, gill arrangement and colour changes, and stipe characteristics. Additionally, microscopic examination was performed to study spore morphology, basidia, sterigmata, and cystidia. Spore prints were obtained to confirm the characteristic dark brown to black coloration, aiding in accurate identification (Nagy *et al*., 2013) [7].

For *Termitomyces*, both macroscopic and microscopic features were considered, including cap size and shape, presence of a central umbo, gill attachment, and the characteristic long pseudorhiza. Microscopic analysis involved the examination of spores, basidia, and cystidia, along with spore print analysis, which typically showed white to pale coloration. The ecological association with termite mounds was also used as a key identifying feature (Aanen *et al*., 2002) [1]. All collected specimens were carefully cleaned, air-dried, and preserved for future reference. Final identification was confirmed by comparing observed characteristics with descriptions available in standard mycological manuals such as Ainsworth & Bisby's Dictionary of the Fungi and other authoritative taxonomic references (Kirk *et al*., 2008) [4].

Results

The field survey conducted across the study area revealed the occurrence of diverse macrofungal taxa, including *Scleroderma, Ganoderma, Leucocoprinus, Coprinellus disseminatus,* and *Termitomyces,* each occupying specific ecological niches within the campus ecosystem.

Ganoderma species were predominantly observed growing on dead and decaying wood, particularly on tree stumps and fallen logs. The basidiocarps were perennial, hard, and woody, exhibiting bracket-shaped morphology with variations in size and surface texture. The upper surface ranged from brown to reddish-brown, occasionally with a laccate (shiny) appearance, while the pore surface varied from cream to brown. Their occurrence was more frequent in shaded and moist areas rich in woody debris. *Scleroderma* species were recorded in multiple locations, particularly in areas with well-developed soil and tree cover. The fruiting bodies were globose to irregular, with thick, leathery peridia and dark-coloured gleba at maturity. They were found partially emergent or subterranean, exhibiting yellowish-brown to dark brown outer surfaces and a firm, tough texture. These fungi were commonly associated with tree bases and organic-rich soils, especially in relatively undisturbed habitats. *Leucocoprinus* species were observed in garden soils and areas rich in decomposing organic matter. The fruiting bodies were small to medium-sized, delicate, and short-lived. Morphologically, they exhibited white to pale yellow caps with smooth to powdery surfaces, slender stipes bearing a fragile annulus, and free, closely spaced gills. Their occurrence was more frequent following rainfall, indicating a preference for moist environmental conditions. *Coprinellus disseminatus* was recorded in dense, clustered formations on decaying wood substrates. Fruiting bodies appeared predominantly under humid conditions, especially after rainfall. The caps were small (0.5–1.5 cm in diameter), initially ovoid and later bell-shaped, with radially striated surfaces ranging from pale grey to cream. Gills were closely crowded, transitioning from white to grey with maturity. The stipe was slender, hollow, fragile, and white, lacking an annulus. The species exhibited a characteristic gregarious growth pattern, forming large colonies. Microscopic examination revealed smooth, elliptical spores that were dark brown to black in colour, with predominantly tetrasporic basidia. *Termitomyces* species were observed in close association with termite mounds, emerging either directly from the mound or from adjacent soil. Fruiting bodies were recorded mainly during the rainy season under humid conditions. They were medium to large in size, with caps measuring 5–15 cm in diameter, initially convex and later flattening with a distinct central umbo. Cap coloration ranged from white to brownish. The gills were free, crowded, and white, while the stipe was long and cylindrical, extending below ground as a pseudorhiza connected to the termite nest.

The texture was firm yet fleshy, and fruiting bodies occurred singly or in small groups. Microscopic analysis showed smooth, elliptical, hyaline spores, predominantly tetrasporic basidia, and the presence of cystidia. The spore print was white, consistent with the genus. Photographic documentation and morphological observations supported the identification of all recorded taxa and highlighted variations in their structural and ecological characteristics across different habitats within the study area.

Fig 1: *Scleroderma*

Fig 2: *Ganoderma*

Fig 3: *Leucocoprinus*

Fig 4: *Coprinellus disseminatus*

Fig 5: *Termitomyces*

Discussion

The present study highlights the ecological significance of macrofungal diversity within a semi-natural campus ecosystem. The occurrence of *Ganoderma, Scleroderma, Leucocoprinus, Coprinellus disseminatus*, and *Termitomyces* reflects the presence of functionally diverse fungal groups contributing to ecosystem processes such as decomposition, nutrient cycling, and symbiotic interactions. The presence of *Ganoderma* species indicates active wood decomposition and nutrient recycling within the campus. As white-rot fungi, Ganoderma species degrade lignin, cellulose, and hemicellulose, facilitating the release of essential nutrients back into the soil. This process enhances soil fertility and supports microbial activity, thereby maintaining ecosystem stability. Their colonization of dead and weakened trees also contributes to natural vegetation turnover and regeneration, even in managed landscapes (Deacon, 2006; Paterson, 2006) [2, 8]. The occurrence of *Scleroderma* species emphasizes the importance of ectomycorrhizal associations in maintaining plant and soil health. By forming mutualistic relationships with tree roots, these fungi enhance nutrient uptake, particularly phosphorus and nitrogen, and improve plant resilience to environmental stress. Additionally, their extensive mycelial networks contribute to soil aggregation, water retention, and reduced erosion, indicating well-functioning soil ecosystems within the campus (Smith & Read, 2008) [10]. *Leucocoprinus* species observed in the study act as efficient saprotrophic decomposers, breaking down organic matter such as leaf litter and plant debris. Their activity promotes nutrient recycling and enriches soil fertility, indirectly supporting plant growth and sustaining soil microbial communities. Although generally considered non-edible or of limited medicinal value, their ecological contribution to organic matter turnover and composting is significant. Similar findings have been reported in urban and semi-urban ecosystems, where *Leucocoprinus* species are commonly associated with organic-rich substrates (Kirk *et al*., 2008; Lodge *et al*., 2004) [4]. The identification of *Coprinellus disseminatus* in dense clusters on decaying wood further highlights the role of saprotrophic fungi in lignocellulosic decomposition. Its gregarious growth pattern suggests an efficient colonization strategy, enabling rapid utilization of nutrient-rich substrates. The species' occurrence predominantly under moist conditions underscores the influence of environmental factors such as humidity and temperature on fungal fruiting. Unlike many ink-cap fungi, *C. disseminatus* exhibits limited deliquescence, which may enhance spore dispersal efficiency and represents an adaptive ecological trait (Nagy *et al*., 2013) [7]. The presence of *Termitomyces* species confirms their obligate symbiotic association with termites. The characteristic pseudorhiza connecting the fruiting body to termite nests illustrates the dependency of the fungus on termite activity. In this mutualistic relationship, termites cultivate the fungus on partially digested plant material, facilitating efficient degradation of cellulose and lignin. This interaction benefits both partners, as the fungus obtains nutrients and a protected environment, while termites gain access to digestible food sources. Consequently, *Termitomyces* plays a significant role in nutrient cycling and soil enrichment (Aanen *et al*., 2002) [1].

The seasonal occurrence of most recorded macrofungi during the monsoon period highlights the critical role of environmental factors such as moisture, temperature, and substrate availability in fungal growth and fruiting. Although species diversity in campus ecosystems may be lower compared to natural forests, the presence of diverse functional groups indicates that managed landscapes can support significant macrofungal diversity and ecological processes (Lodge *et al*., 2004) [5]. Overall, the study underscores the ecological importance of macrofungi in maintaining soil health, supporting plant growth, and sustaining ecosystem functioning. It also highlights the need for continued documentation and conservation of fungal diversity in semi-urban and institutional environments.

Conclusion

The present study documents the occurrence and diversity of macrofungi within a semi-natural college campus ecosystem, highlighting the presence of ecologically significant genera such as *Ganoderma, Scleroderma, Leucocoprinus, Coprinellus disseminatus,* and *Termitomyces.* The findings demonstrate that even managed institutional landscapes can support a wide range of macrofungal communities representing diverse functional groups, including saprotrophic, ectomycorrhizal, and symbiotic fungi. Each of the recorded taxa contributes uniquely to ecosystem functioning. *Ganoderma* and *Coprinellus disseminatus* play key roles in lignocellulosic decomposition, *Leucocoprinus* contributes to organic matter turnover, Scleroderma enhances plant nutrition through mycorrhizal associations, and *Termitomyces* exemplifies a specialized mutualistic relationship with termites that accelerates nutrient cycling. Together, these fungi support soil fertility, plant health, and overall ecosystem stability. The seasonal occurrence of macrofungi during the monsoon period further emphasizes the influence of environmental factors such as moisture and temperature on fungal growth and distribution. The study also highlights the importance of campus ecosystems as valuable sites for biodiversity documentation and ecological research.

Overall, this investigation underscores the need for continued exploration, documentation, and conservation of macrofungal diversity in semi-urban landscapes. Such efforts not only enhance our understanding of fungal ecology but also promote awareness of their ecological, economic, and potential biotechnological significance.

References

1. Aanen DK, *et al*. The Evolution of Fungus-Growing Termites and Their Mutualistic Fungal Symbionts. Proceedings of the National Academy of Sciences,2002:99(23):14887–14892.
2. Deacon JW. Fungal Biology. 4th ed., Blackwell Publishing, 2006.
3. Hawksworth DL. The Magnitude of Fungal Diversity: The 1.5 Million Species Estimate Revisited. Mycological Research,2001:105(12):1422–1432.
4. Kirk PM, *et al*. Dictionary of the Fungi. 10th ed., CAB International, 2008.
5. Lodge DJ, *et al*. Collecting and Describing Macrofungi. Biodiversity of Fungi: Inventory and Monitoring Methods, edited by Mueller GM, *et al*., Elsevier Academic Press, 2004, 128–158.
6. Mueller GM, *et al*. Biodiversity of Fungi: Inventory and Monitoring Methods. Elsevier Academic Press, 2004.
7. Nagy LG, *et al*. Morphological Characterization and Phylogenetic Relationships of *Coprinellus* Species. Mycological Progress,2013:12(2):379–388.
8. Paterson RRM. *Ganoderma* – A Therapeutic Fungal Biofactory. Phytochemistry,2006:67(18):1985–2001.
9. Pegler DN. A Preliminary Agaric Flora of East Africa. Her Majesty’s Stationery Office, 1977.
10. Smith SE, Read DJ. Mycorrhizal Symbiosis. 3rd ed., Academic Press, 2008.
11. Wasser SP. Medicinal Mushroom Science: Current Perspectives, Advances, Evidence, and Challenges. Biomedical Journal,2010:3(2):1–10.