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ASSESSMENT OF MACROFUNGI IN SIARGAO ISLAND, PHILIPPINES

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ABSTRACT

This study assessed the occurrence and taxonomic composition of macrofungi in Siargao Island, where fungal diversity remains underdocumented. Surveys were conducted in 2025 (October, November, December) and 2026 (March, May) using a standardized transect sampling method with spatial and temporal replication. Mushrooms were photomicrographed in situ, collected, and identified based on their morphological characteristics and taxonomic references. Diversity indices were used to quantify species richness and distribution across sampling months. A total of 50 macrofungal taxa were collected and morphologically identified, belonging to 2 phyla, 6 orders, 21 families, and 32 genera. The most frequently collected species are *Lentinus* s*p.* (13.78%), *Schizophyllum commune* (13.36%)*, Auricularia auricula-judae* (11.51%), *Pleurotus* sp. (9.79%), *Gymnopilus* sp. (6.62%). Species richness varied among sampling months, with December showing the highest number of species (27) and the highest Shannon diversity index (H' = 2.93). Most recorded taxa were lignicolous fungi, showing that woody substrates dominate in the agroforestry system and influence macrofungal distribution. The presence of edible and medicinal species highlights the ecological and socio-economic value of macrofungi in the island. This assessment provides baseline information on macrofungal diversity in Siargao Island and helps fill a biogeographic gap in the documentation of macrofungal diversity in island ecosystems.

KEYWORDS: conservation, distribution, diversity, mushroom, occurrence

INTRODUCTION

The Philippines is recognized as a biodiversity hotspot; however, relative to plants and animals, fungal diversity remains comparatively underdocumented. Macrofungi, commonly referred to as mushrooms, are a diverse group of fungi characterized by visible fruiting bodies. These organisms play essential ecological roles in nutrient cycling, decomposition of organic matter, and the formation of symbiotic relationships. Despite their ecological importance, macrofungi remain poorly studied in many regions due to their seasonal appearance and limited taxonomic studies. Assessing macrofungal diversity is crucial for understanding ecosystem health, as the presence, abundance, and composition of macrofungi can serve as indicators of environmental conditions and habitat quality. Moreover, baseline data on macrofungi are necessary to monitor changes in fungal communities in response to land-use change, climate variability, and anthropogenic disturbances.

Studies document high macrofungal diversity, with over 14,000 species worldwide and around 350 edible species (Tuo et al. 2022). Macrofungal studies have been conducted in different parts of the Philippines. A checklist of naturally occurring mushrooms in the Philippines, based on papers on wild mushrooms published from 2001 to 2021, was reported by Dulay et al. (2023). It has been noted that most biodiversity surveys of wild mushrooms in the Philippines have been conducted primarily in many provinces of Luzon. Such studies were conducted in Southern Luzon, where macrofungal diversity in a protected mountain forest ecosystem was investigated and reported to have unique species composition (Parlucha et al. 2021). Tadiosa et al. (2021) collected 66 macrofungi species from the watershed forest reserve in Catanduanes during the rainy season (September-December 2017). However, very few studies were conducted in the Visayas and Mindanao, such as those in Bukidnon by Asido et al. (2024), Perpetua et al. (2014), and Baynosa et al. (2025). This compilation of Philippine macrofungi indicates that the distribution data is still incomplete. Macrofungal inventories remain geographically uneven.

Despite increasing studies on macrofungi in Luzon, geographic bias persists due to limited sampling in ecosystems such as Siargao Island, situated in the northeast of Mindanao. Siargao Island is recognized not only for its world-renowned tourism but also for its ecological importance as the Siargao Island Protected Landscape and Seascape. The Del Carmen mangrove reserve on the island was also declared a Ramsar site in 2024. The island hosts a rich diversity of flora, fauna, and microfungal species (Besitulo et al. 2010) that play vital roles in nutrient cycling and forest ecosystem health. At the same time, Siargao's vibrant tourism industry attracts thousands of visitors each year for activities such as surfing, island hopping, and nature exploration. This coexistence of high biodiversity and active tourism highlights the need for sustainable management practices to conserve the island's natural resources while supporting responsible tourism development. Siargao Island has not been previously explored for macrofungi diversity. Given its agroforestry landscape, microclimatic conditions, and habitat heterogeneity, the area may harbor unique species assemblages and diverse lignicolous and saprotrophic taxa due to its remote location. To date, no published macrofungal inventory exists for Siargao Island, highlighting a significant geographic gap in the knowledge of Philippine fungal diversity. Therefore, this study conducted a rapid assessment of macrofungi diversity in Del Carmen, Siargao Island, to document the taxa present and provide baseline taxonomic data for future biodiversity and conservation studies.

MATERIALS AND METHODS

Entry Protocol

Prior to conducting the study, permission was obtained from the Municipal Government of Del Carmen through a formal request letter and Prior Informed Consent (PIC). The study was conducted in collaboration with the Department of Biology, Ateneo de Manila University.

Study Area

The study was conducted in km 1 National Highway, purok 7, barangay poblacion Del Carmen, Surigao del Norte (9°52′07″N, 125°58′14″E) on Siargao Island in northeastern Mindanao, Philippines. Situated on the western side of the island within the Caraga Region, the area is characterized mainly by coconut-based agroforestry with secondary vegetation dominated by several wild tree species. Fieldwork was carried out from October, November, December 2025, March and May 2026, a period that coincides with the region's wet season, which provides a favorable condition for the growth of macrofungi.

Sample Collection

The transect walk method, adapted from Perpetua (2025), was used to collect the macrofungi samples. To ensure spatial independence, three (3) parallel transects, each measuring 500 meters and spaced 10 meters apart, starting approximately 200 meters from the national highway, were established in the study area to minimize anthropogenic disturbance. These transects serve as spatial replicates to determine variability in the occurrence of macrofungi across the sampling site. Each transect was surveyed systematically, and all visible and distinguishable fruiting bodies within the transect boundaries were recorded. The collection was carried out in October, November, December 2025, March and May 2026. These sampling periods served as a temporal replicate to account for seasonal variation in the diversity and distribution of macrofungi in the study area. Information on substrate type (wood, soil, or leaf litter) and habitat characteristics was recorded.

Collected specimens were dried and preserved for further documentation, verification and as reference for future studies. Thus, there is no need to dispose of the samples collected. And if there is a need to dispose, mushrooms are natural organic matter, disposal does not pose significant risk. This study recognizes the ecological and scientific value of the specimen, hence, destruction and improper disposal will be avoided.

Specimen Processing

All mushroom species encountered along the identified transects were photographed in situ and collected. To avoid duplicate sampling, only visible, distinct fruiting bodies were recorded and collected. Large mushrooms were wrapped in aluminum foil, and small mushrooms were placed in compartmentalized containers to prevent damage and cross-contamination. Collected mushroom specimens were oven-dried at 40-45 °C for 24-48 hours, depending on size [19]. Voucher specimens were deposited in the Ateneo Biodiversity Laboratory, Ateneo de Manila University, for future verification and taxonomic studies.

Identification of the Macrofungi

The macrofungi were documented in the natural environment, including pileus shape, color, surface texture, lamellae characteristics, stipe morphology, and substrate preference. Identification was carried out using standard mycological references, including [14], and supplemented by available and related taxonomic literature, and scientific names were cross-checked with online fungal databases such as Index Fungorum and Mycobank. The identification was mainly morphology-based; therefore, DNA barcoding (ITS region) is recommended in future studies for taxonomic confirmation.

Data Analysis

Species diversity was calculated using the Shannon-Wiener index. Relative abundance (%) was calculated as:

Relative abundance (%) = (number of individuals per species)/total number of individuals x 100

Species occurrence was categorized as follows: frequent (>4%), common (3-3.9%), and infrequent (<3%). As the study was exploratory in nature, the differences in species richness were compared descriptively across sampling months.

RESULTS AND DISCUSSION

Taxonomic Composition

A total of 50 macrofungal taxa were documented in Del Carmen, Surigao del Norte (Table 1). Of these, 24 taxa were identified to species level, while 20 were identified to genus level. The recorded taxa belong to 2 phyla, 6 orders, 21 families, and 32 genera. Most species belonged to Phylum Basidiomycota, which included five orders, 18 families, and 29 genera, while the remaining taxa belonged to Phylum Ascomycota.

The Family Polyporaceae recorded the highest number of species in the survey, consistent with previous reports of Philippine macrofungal diversity, in which wood-decaying fungi are commonly encountered in forest and agroforestry environments (Dulay et al. 2023; Baynosa et al., 2025). This pattern suggests that substrate availability plays a significant role in shaping the fungal communities on the island.

Table 1. Taxonomic composition of macrofungi in Del Carmen, Siargao Island, Philippines.

Phylum	**Order**	**Family**	**Genus/Species**
Basidiomycota	Agaricales	Agaricaceae	*Agaricus* sp.
			Chlorophyllum sp.
			Lycoperdon sp.
		Amylocorticiaceae	*Plicatura pendula* Albertini & Schweinitz
		Entolomataceae	*Entoloma conferendum* Britzelm.
			Entoloma vernum S.Lundell.
		Hymenogastraceae	*Gymnopilus* sp.
		Mycenaceae	*Mycena chlorophos* (Berk. & M.A.Curtis) Sacc.
			Mycena galericulata (Scop.) Gray (1821)
			Mycena semivestipes (Peck) A.H. Sm.
			Mycena sp.
		Omphalotaceae	*Marasmiellus* sp.
			Marasmiellus vaillantii (Pers.) Singer
		Pleurotaceae	*Pleurotus* sp.
		Pluteaceae	*Pluteus atromarginatus* (Konrad) Kühner
			Pluteus sp. 1
			Pluteus sp. 2
		Psathyrellaceae	*Coprinopsis* sp.
			Parasola plicatilis (Curtis)Redhead
			Parasola sp.
		Schizophyllaceae	*Schizophyllum commune* E.M.Fries 1815
		Tricholomataceae	*Delicatula integrella*
		Tubariaceae	*Tubaria sp.*
		Volvariellaceae	*Volvariella* sp.
	Auriculariales	Auriculariaceae	*Auricularia auricular-judae* (Bull.) J.Schrot.
	Phallales	Phallaceae	*Phallus indusiatus* Vent.
	Polyporales	Ganodermataceae	*Ganoderma applanatum* (Pers.) Pat.
			Ganoderma lucidum Karst
			Ganoderma sp.
		Polyporaceae	*Earliella* sp.
			Daedaleopsis sp.
			Hexagonia sp.
			Leiotrametes sp.
			Lentinus arcularius (Batsch)Zmitr.
			Lentinus sp.
			Lentinus velutinus Fr.
			Microporus sp.
			Microporus xanthopus (Fr.) Kuntze
			Poronidulus sp.
			Pycnoporus sanguineus (L.)Murrill,Bull.Torrey
			Trametes gibbosa (Pers.) Fr.
			Trametes hirsuta (Wulfen) Lloyd
			Trametes ochracea (Pers.)Gilb.&Ryvarden
			Trametes villosa (Sw.) Kreisel
			Trametes sp. 1
			Trametes sp. 2
		Steccherinaceae	*Nigroporus* sp.
Asctomycota	Rhytismatales	Cudoniaceae	*Spathularia* sp.
	Xylariales	Hypoxylaceae	*Hypoxylon* sp.
		Xylariaceae	*Xylaria hypoxylon* (L.)Grev.

Occurrence and Relative Abundance

The occurrence of macrofungi was determined based on the frequency of collections during the field survey. Species were categorized as frequent (>4%), common (3-3.9%), and infrequent (<3%) (Table 2). In this study, the most frequently recorded taxa were *Lentinus* sp. (13.78%), *Schizophyllum commune* E.M.Fries (13.36%), *Auricularia auricular-judae* (Bull.) J.Schrot. (11.51%), *Pleurotus* sp. (9.79%), *Gymnopilus* sp. (6.62%), and *Trametes ochracea* (Pers.)Gilb.&Ryvarden (5.53%). *Plicatura pendula* Albertini & Schweinitz (3.99%) and

Pycnoporus sanguineus (L.)Murrill, Bull. Torrey (3.44%) were categorized as common species, while the majority of taxa (42 species) were encountered infrequently (Table 2).

Dulay et al. (2023) reported that the most frequently encountered species of Philippine wild mushrooms are *Schizophyllum commune, Ganoderma lucidum, Ganoderma applanatum, Auricularia polytricha, and Microporus xanthopus.* In this study, the dominance of *Schizophyllum commune* and other widely reported taxa aligns with findings from previous studies on Philippine macrofungal diversity. Based on the checklist of studies from 2001 to 2021, other species in this study, already reported from other areas in the Philippines, include *Entoloma conferendum, Mycena galericulata, Parasola plicatilis, Auricularia auricular-judae, Phallus indusiatus, Lentinus tigrinus,* and *Trametes ochracea.*

Fig. 1. Representative macrofungal species recorded in Siargao Island, Philippines.
(a) *Lentinus* sp., (b) *Schizophyllum commune,* (c) *Auricularia auricular-judae,*
(d) *Pleurotus* sp., (e) *Gymnopilus* sp., (f) *Trametes ochracea*

These results indicate that these species are ecologically adaptable and can inhabit diverse habitats. Moreover, the frequent occurrence may be attributed to efficient spore dispersal, substrate utilization, and tolerance to environmental variability.

Taxa identified to the species level in this study which were not listed in the previously published Philippine checklist, including *Entoloma vernum, Mycena chlorophos, Mycena semivestipes, Marasmiellus vaillantii, Pluteus atromarginatus, Delicatula integrella,* and *Lentinus arcularius.* These also include 26 out of 50 taxa that were identified only up to genus level, such as *Gymnopilus* sp. (6.62%), *Leiotrametes* sp. (2.27%), *Trametes sp. 1* (1.09%), *Chlorophyllum* sp. (1.09%), *Ganoderma* sp. (1.09%), and *Volvariella* sp. (0.83 %). The dominance of lignicolous taxa showed that agroforestry systems provide suitable niches for wood-decaying fungi.

Table 2. Relative abundance and occurrence of macrofungi in Del Carmen, Siargao Island.

Genus/Species	**Oct**	**Nov**	**Dec**	**Mar**	**May**	**% occurrence**
Agaricus sp.	1					0.09
Chlorophyllum sp.		12				1.09
Lycoperdon sp.			9		11	1.81
Plicatura pendula				44		3.99
Entoloma conferendum	18					1.63
Entoloma vernum			7			0.63
Gymnopilus sp.	22	21	14	7	9	6.62
Mycena chlorophos		8				0.72
Mycena galericulata			24			2.17

Mycena semivestipes	31					2.81
Mycena sp.					25	2.27
Marasmiellus sp.	2		1			0.27
Marasmiellus vaillantii			14			1.27
Pleurotus sp.	37	15	27	11	18	9.79
Pluteus atromarginatus	1					0.09
Pluteus sp. 1	1					0.09
Pluteus sp. 2			1			0.09
Coprinopsis sp.					5	0.45
Parasola plicatilis	2					0.18
Parasola sp.					7	0.63
Schizophyllum commune	45	33	46	21	25	13.36
Delicatula integrella			23			2.12
Tubaria sp.	6					0.55
Volvariella sp.	9				8	0.83
Auricularia auricular-judae	40	18	29	15	20	11.51
Phallus indusiatus	10				3	1.18
Ganoderma applanatum	5	3	6			1.27
Ganoderma lucidum				8		0.72
Ganoderma sp.	8	4				1.09
Earliella sp.			2		4	0.54
Daedaleopsis sp.			5			0.45
Hexagonia sp.					3	0.27
Leiotrametes sp.	25					2.27
Lentinus arcularius		6	2		19	2.45
Lentinus sp.	45	29	39	16	23	13.78
Lentinus velutinus				5		0.45
Microporus sp.					3	0.27
Microporus xanthopus			6			0.54
Poronidulus sp.			2			0.18
Pycnoporus sanguineus	12	5	14	7		3.44
Trametes gibbosa					5	0.45
Trametes hirsute			3	2		0.45
Trametes ochracea	26	12	14	9		5.53
Trametes villosa			16	12		2.54
Trametes sp. 1			12			1.09
Trametes sp. 2			5			0.45
Nigroporus sp.			2			0.18
Spathularia sp.			20			1.81
Hypoxylon sp.	12					1.09
Xylaria hypoxylon	26					2.36

Moreover, some taxa identified to species level may represent potentially new locality records for Mindanao; however, molecular validation is needed for further taxonomic review. Sole reliance on morphology-based identification and fruiting body surveys, however, provides an incomplete representation of fungal community composition in Siargao Island. Nevertheless, this study likely represents the first documented macrofungal inventory of Siargao Island and may address a major geographic gap in mycological studies in the Philippines.

Temporal Distribution and Diversity Patterns

Temporal variations in the fungal communities collected in 2025 (October, November, December) and 2026 (March, May) were recorded, suggesting a strong seasonal influence on macrofungal fruiting patterns. The highest species richness was recorded in December (27 species), with the highest Shannon diversity index (H' = 2.93). November and March showed lower species richness with 15 and 22, respectively.

The higher diversity recorded in December is likely due to optimal moisture conditions during this month, which are essential for mycelial growth and fruiting body formation. Seasonal variation in mushroom communities has been extensively studied and is strongly affected by climatic conditions such as temperature, precipitation, and humidity.

Compared with the diversity indices reported (Parlucha et al. 2021) for protected forests such as Mount Banahaw-San Cristobal (H'=3.14) and Quezon Protected Landscape (H'=3.04), the diversity index recorded in this study is slightly lower. The result, however, is comparable to Mt. Makiling Forest Reserve (H'=2.79). Variations in habitat complexity, vegetation structure, and disturbance most likely drive the differences.

Frequently occurring species such as *S. commune, Lentinus* sp., *A. auricular-judae*, *Pleurotos* sp., *Gymnopilus* sp., *T. ochracea,* and a common species, *P. sanguineus* were consistently present across all sampling months, suggesting consistent resource availability. On the other hand, some taxa appeared only in specific months, such as *Volvariella* sp. (October and May), *Plicatura pendula* (March) and *Mycena semivestipes* (October), suggesting a specialized ecological niche and possibly low tolerance to habitat and environmental changes.

Environmental Factors Shaping Macrofungal Distribution
Multiple ecological factors likely influenced the documented patterns in macrofungal occurrence and diversity. Vegetation structure, specifically tree species richness and canopy cover, are strong determinants of macrofungi abundance and composition (Hu et al. 2022). Climatic variables, such as precipitation, air humidity, temperature, and wind velocity, are positively correlated with macrofungi occurrence, often exhibiting seasonal lag effects. While soil properties (including pH, nutrients, and organic matter) and topography influence occurrence, their effects are scale-dependent, with edaphic factors being more influential at the local level. Furthermore, the composition of macrofungi is significantly affected by substrate type and availability; for instance, the dominance of lignicolous taxa in agroforestry systems is directly linked to the abundance of woody substrates. This suggests that macrofungal diversity in Del Carmen, Siargao Island, is largely determined by substrate type and availability, as well as agrosystem structure.

Ecological and Economic Significance
It is interesting to note that four (4) of the frequently collected fungal species: *S. commune* (Kumar and Yu 2025), *Lentinus* sp. (Dulay et al. 2014), *A. auricular-judae* (Badalyan and Borhani 2019), and *Pleurotus* sp. (Van Dam et al. 2014), which were present in the 5-month collection, are known to be edible or medicinal. *Ganoderma lucidum, recorded* in March, is widely recognized for its medicinal benefits (Ekiz et al. 2023). Studies reported that mushrooms have bioactive compounds with potential anticancer, antifungal, antimicrobial, antidiabetic, antitumor, antioxidant, and other health benefits (Singh et al. 2025, Zade et al. 2025, Feleke and Doshi (2017). Therefore, the presence of these species on the island highlights the potential of mushrooms as alternative sources of nutrition and livelihood in local communities in Del Carmen. Consumption, however, should not be recommended without proper taxonomic identification and toxicological evaluation, as misidentification may pose health risks.
Moreover, some species are present only in the area at a particular month, such as *Mycena semivestipes,* collected only in October, *Mycena chlorophos* collected in November, whereas *Mycena galericulata* was found only in December. Notable species include *Volvariella* sp., which was collected in October 2025 and May 2026, and is known to be edible and highly regarded in Asian cuisine (Abdulrajak and Priya 2025). *Ganoderma lucidum,* collected in March, is known as a medicinal mushroom with bioactive compounds that exhibit antioxidant, anti-inflammatory, and antidiabetic effects (Ekiz et al. 2023).
The presence of macrofungi indicates tolerance to environmental conditions, which likely contributes to its stable distribution. At the same time, its economic relevance, whether through agriculture, industry, biotechnology, or ecosystem services, highlights its direct and indirect impact on human activities. The observed diversity suggests potential for strain selection, improvement, and targeted management strategies. This diversity may enhance productivity in beneficial applications while also requiring careful monitoring. The importance of continued research, sustainable management practices, and informed utilization to maximize benefits while minimizing negative impacts associated with this fungal community remains.

CONCLUSION
This study represents a rapid biodiversity assessment conducted over a relatively short sampling period. The recorded diversity, 50 taxa across multiple sampling periods, likely represents only a portion of the macrofungal community present in the area. The wild macrofungi identified in this study, however, are diverse and have ecological and economic relevance. Siargao Island is a rich but poorly studied area for fungal diversity. The results emphasized the importance of incorporating fungal diversity into conservation and management strategies within the Siargao Island Protective Landscape and Seascape. Molecular identification, long-term monitoring, and an extended sampling strategy are needed to better understand macrofungal diversity and distribution in the island.
Overall, this study contributes important baseline data to address the geographic gap in macrofungal research in Mindanao and supports the need for continued biodiversity documentation and conservation efforts in Siargao Island.

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