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Diversity and Bioprospecting Potential of Lignicolous in the Jambi University Educational Forest

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Abstract

Wild lignicolous are a group of that play a crucial role in wood decomposition and nutrient cycling in forest ecosystems. Furthermore, these lignicolous represent a hidden gem for herbal medicine. This research aims to investigate the diversity and bioprospecting potential of wild lignicolous located at the periphery of the University of Jambi Educational Forest. The study employed a combined exploratory-analytical method and literature review, with stages including fungal sampling and collection, morphological characterization and identification, and a literature-based study on their bioprospecting potential. The results revealed the collection of 17 wood fungus samples with distinct morphological characteristics. Eleven of these samples were successfully identified, while seven remain unidentified. All identified samples belong to the Phylum Basidiomycota, Order Agaricomycetes, and are divided into 3 Classes (Agaricales, Polyporales, Auriculariales) and 6 Families (Mycenaceae, Polyporaceae, Fomitopsidaceae, Auriculariaceae, Schizophyllaceae, and Agaricaceae). The from these six families have diverse applications, including use as food sources, herbal medicine ingredients, and decomposers. In conclusion, the wood obtained from the edge of the University of Jambi Educational Forest are diverse and possess significant bioprospecting value worthy of further development.

Keywords: Basidiomycota; Bioprospecting; Lignicolous; Jambi University

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INTRODUCTION

Represent a kingdom of immense biodiversity, playing critical roles in ecosystem functioning, particularly in nutrient cycling and decomposition. Among them, lignicolous that inhabit and decay wood are pivotal agents in wood decomposition and nutrient cycling in forest ecosystems. Through the secretion of a robust array of cellulolytic and ligninolytic enzymes, these break down the complex polymers of wood, such as lignin, cellulose, and hemicellulose, thereby releasing carbon and nutrients back into the soil. This process is essential for the health and sustainability of forest habitats.

Beyond their ecological significance, lignicolous have garnered substantial scientific and economic interest as a prolific source of novel bioactive compounds and enzymes with immense bioprospecting potential. They are a treasure trove for various industries, including pharmaceuticals, biotechnology, and bioremediation. For instance, numerous studies have documented their ability to produce antibacterial, antifungal, and anticancer compounds. Furthermore, the unique enzymatic machinery of white-rot and brown-rot, capable of degrading lignin selectively or completely, holds great promise for applications in biofuel production, pulp biobleaching, and the degradation of persistent environmental pollutants.

The Jambi University Educational Forest represents one such unique and ecologically significant area, serving as a living laboratory and a conservation site. However, like many forest areas in Indonesia, a comprehensive study focusing on the diversity and potential applications of its lignicolous fungal communities remains limited. In an era of increasing antibiotic resistance and industrial demand for novel enzymes, the bioprospecting of unique ecological niches like this forest has become critically important. This process is not merely about discovery but also about valuing and preserving biodiversity by translating it into tangible benefits for medicine, such as new antimicrobial drugs, and for industry, such as more efficient bio-catalysts. Therefore, this research is crucial to address this knowledge gap. The present study aims to systematically investigate the diversity and explore the bioprospecting potential of lignicolous within the Jambi University Educational Forest to unlock their hidden potential. The findings are expected not only to contribute to the scientific inventory of Indonesian fungal resources but also to provide valuable insights for their future exploitation in sustainable biotechnological applications.

METHODS

Research Design

This study employs a combined approach of exploratory research and literature review. The exploratory research was conducted to collect samples of wild lignicolous from the Jambi University Educational Forest, while the literature review was carried out to investigate the bioprospecting potential of the collected and identified wild wood. The research was conducted from August to November 2025 at the Jambi University Educational Forest and the Agroindustry, Medicinal Plants, and Biotechnology Laboratory of the Faculty of Science and Technology at Jambi University.

Research Target/Subject

The subject of this research was the community of lignicolous present within the Jambi University Educational Forest. A total sampling approach was employed, whereby every fungal specimen encountered within the designated study area was documented. Each sample was photographed in situ to record its natural habitat and appearance, followed by a detailed observation of its macro-morphological characteristics. Subsequently, the specimens were carefully collected and preserved for further, more detailed examination in the laboratory.

Research Procedure

The research was conducted systematically in three primary stages: (1) fungal sampling and collection, (2) morphological characterization and identification, and (3) a literature-based study on the bioprospecting potential of the identified species.

1. Fungal Sampling and Collection: This stage was carried out through a series of field surveys across different transects within the Jambi University Educational Forest. Samples of wild lignicolous (including fruiting bodies and the underlying substrate wood) were carefully collected from various decaying logs, stumps, and branches. The samples were then photographed in situ before being aseptically placed into sterile container for transport to the laboratory to prevent contamination and preserve their integrity.

2. Morphological Characterization and Identification: In the laboratory, a more detailed macro-morphological examination was conducted. Macroscopic characterization included documenting the features of the fruiting body: size, shape, cap and stipe morphology, color, texture, and the structure of the hymenium (pores, gills, or teeth). For taxonomic identification, the observed characteristics were systematically compared with established morphological criteria found in specialized monographs and relevant journal articles.

3. Literature-Based Study on Bioprospecting Potential: Following identification, a comprehensive literature review was conducted for each successfully identified fungal species. Scientific databases such as Google Scholar, PubMed, and ScienceDirect were systematically searched using the scientific names of the as primary keywords. The review focused on gathering existing scientific evidence on the bioprospecting potential of these species, specifically looking for reported activities such as: A). Enzymatic Potential; B). Antimicrobial Activity; C). Other Bioactivities; and D). Nutraceutical and Food Applications.

Instruments, and Data Collection Techniques

The materials and equipment utilized for the collection of wild lignicolous comprised pencils, permanent markers, clipboards, a smartphone camera, a millimeter block, sample containers, a ruler, and a refrigerator for the temporary preservation of samples. The primary objects of study were the wild lignicolous themselves. Data on the morphological characteristics of the collected specimens were obtained through direct, in-situ observation. The macro-morphological assessment focused on the following key features: pileus (cap) texture and color, hymenophore texture and color (e.g., of gills, pores, or teeth), stipe (stalk) presence or absence, ancillary structures (presence or absence of specific features such as partial or universal veil and a volva).

Data analysis technique

The primary data, consisting of the recorded macroscopic morphological characteristics of the wild lignicolous, served a dual purpose. Firstly, it was used for the taxonomic identification of the. Secondly, it provided the foundational reference for subsequent literature searches to uncover their bioprospecting potential. The observed morphological traits served as the key diagnostic characters. Identification was carried out by systematically matching these observed characteristics against descriptions in mycological reference books and peer-reviewed taxonomic publications. Following successful identification, the fungal scientific names were used as keywords to investigate their bioprospecting potential. This was achieved through an extensive literature review of both books and scientific journals. The journal sources were prioritized for international publication and full accessibility to ensure a comprehensive and unbiased collection of data on the enzymatic and bioactive properties of the identified species.

RESULTS AND DISCUSSION

The results revealed the collection of 17 wood fungus samples with distinct morphological characteristics. Eleven of these samples (Table 1) were successfully identified, while seven remain unidentified . All identified samples belong to the Phylum Basidiomycota, Order Agaricomycetes, and are divided into 3 Classes (Agaricales, Polyporales, Auriculariales) and 6 Families (Mycenaceae, Polyporaceae, Ganodermataceae, Fomitopsidaceae, Auriculariaceae, Schizophyllaceae, and Agaricaceae).

Table 1. Morphological Character and Identification Result of Lignicolous

Sampel code	Morphological Character	Identification Result
HU2	The pileus (cap) exhibited a smooth texture and a reddish-orange coloration. The hymenophore was lamellate (gill-like), with white, distantly spaced lamellae. A central stipe (stalk) was present. Neither a veil nor a volva was observed.	*Mycena sp.*
HU4	The pileus (cap) was wrinkled yet smooth to the touch, with a coloration of alternating dark and light brown concentric zones, resembling annual rings. The hymenophore was poroid (pitted) and white, with pores measuring approximately 1-2 mm in diameter. A stipe (stalk) was absent.	*Daedaleopsis sp.*
HU5; HU9	The pileus (cap) exhibited a rough texture and a dark brown coloration, marked by distinctive dark brown curved lines. The hymenophore was poroid, displaying a white to brown color with corresponding yellow curved lines. The fungus was predominantly sessile, lacking a well-defined stipe (stalk), and was attached to the substrate by a slight, lateral holdfast.	*Ganoderma applanatum*
HU6	The pileus (cap) was rough-textured and exhibited a whitish-yellow coloration. The hymenophore was white with a slight greenish tint. A stipe (stalk) was absent. The specimen was collected from a dead log.	*Fomitopsis sp.*
HU7	The fungal pileus (cap) was rough-textured, concave, and orange. It featured longitudinal striations radiating from the stipe base to the cap margin, and the cap margin itself was wavy. The hymenophore was poroid and orange. The stipe (stalk) was short and laterally attached.	*Pycnoporus sp.*
HU10	The entire fruiting body was brown and smooth. Its consistency was gelatinous in moist portions but became stiff upon drying. A short stipe (stalk) was present.	*Auricularia spp.1*
HU13	The fungus was small, approximately 1-3 cm in diameter. The pileus (cap) was whitish-grey with a smooth, hairy (tomentose) texture. The hymenophore was lamellate (gill-like), longitudinally split, and moderately dense. A short stipe (stalk) was laterally attached.	*Schizophyllum commune*
HU15	The pileus (cap) was light brown near the margin, darkening towards the base, with concentric growth zones resembling annual rings on the upper surface. The hymenophore was poroid with approximately 2-3 pores per millimeter, appearing light brown with white areas near the margin. The stipe (stalk) was very short and appeared almost fused with the cap.	*Trametes sp.*
HU17	The fruiting body was round, cup-shaped, brown, and smooth. Its texture was distinctly gelatinous when hydrated, becoming stiff and rigid upon drying.	*Auricularia spp.2*
HU18	The fruiting body was white and hairy (tomentose). Upon collection, the specimen was still in a budding (immature) stage. It possessed a centrally attached stipe.	*Leucocoprinus sp.*

Figure 1 presents the photographic documentation of each wild lignicolous fungal sample obtained during the collection from the Jambi University Educational Forest.

Figure 1. Lignicolous identified from the Jambi University Educational Forest: a). Mycena sp.; b). Daedaleopsis sp.; c). Ganoderma applanatum; d). Fomitopsis sp.; e). Favolus sp.; f). Auricularia cf cornea; g). Schizophyllum commune; h). Trametes sp.; i). Auricularia sp.2; and j). Leucocoprinus sp.

CONCLUSIONS

In conclusion, the wood obtained from the edge of the University of Jambi Educational Forest are diverse and possess significant bioprospecting value worthy of further development.

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AUTHOR CONTRIBUTIONS

Conceptualization, A.L.D., A.P.N., and H.U.M.; Methodology, A.L.D., H.U.M., and P.D.M.; Validation, A.L.D. and H.U.M.; Investigation (Sample Collection), A.L.D., J.M.T., E.A.D., A.P.N., and P.D.M.; Data Curation, J.M.T., E.A.D., P.D.M., and A.L.D.; Writing – Original Draft Preparation, A.L.D., J.M.T., E.A.D.; Writing – Review & Editing, A.L.D. and H.U.M.; Visualization, A.L.D.; Supervision, H.U.M.; Project Administration, T.W. and A.P.N.; Funding Acquisition, A.L.D.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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