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Ethnomicology of Basidiomycota fungus species in Central Kalimantan open forests

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Abstract. The role of fungus Basidiomycota can be used as an indicator of wisdom and the level of maturity forest ecosystems, both as decomposers, symbionts, and pathogens. The existence of several species of edible mushrooms is also used by local communities as food and medicine. This study aims to identify the diversity of fungus species in Central Kalimantan's open forests, as part of ethnomicological information. The method used was the purposive sampling technique. The results showed 3,715 fruiting bodies of mushroom from 120 species and 41 genera were found at the study site with moderate levels of biodiversity (R '= 3.51; H' = 2.14; D '=0.68). Based on the study of ethnomicology information obtained 5 species of edible mushrooms that are commonly consumed by local communities, such as, cloud ear fungus (*Auricularia polytricha*), Oyster Mushroom (*Pleurotus ostreatus*), *Hygrocybeal calc*, *Cantharellos*, and Common Puffball (*Lycoperdon pertatum*). For the type of fungus that is used as an ingredient for disease treatment, 2 types are found, namely *polyporus cinnabarius*, and *ganoderma*. The research findings found that Central Kalimantan's open forest biodiversity is still quite good, with a moderate level of diversity. Besides, ethnomicology can be developed as local wisdom in Central Kalimantan.

1. Introduction

Central Kalimantan is one of the provinces which has a unique type of tropical rain forest because it is located at the latitude of the equator. Tropical rain forests in Kalimantan are known as forest types that have high biodiversity diversity [1]. The percentage of biological natural wealth especially for mushroom species in the tropical rain forests of Central Kalimantan has not been documented as a whole. It is estimated that 1,500,000 species of fungi exist throughout the world, of which 200,000 of them are in Indonesia. The exploration data includes microfungi and macrofungi, including those that can be consumed as a source of food or medicine, and also mushrooms that cannot be consumed (poisonous). But for specific biodiversity in the basidiomycetes group, especially in the open forest area of Central Kalimantan, it has not been documented accumulatively.

Basidiomycetes are part of the Basidiomycota phylum, in which this group of fungi has a microscopic sexual structure shaped like a club or basidium [2]. The word "basidio" means "small foundation," which refers to how basidium holds spores. Spores based on this basidium are called basidiospores, which are

formed during sexual reproduction [3]. Basidiomycota is a filamentous fungus composed of mycelium and hyphal hyphae. This group of Basidiomycota fungi is known as an important decomposer for wood or other material, and in certain species is a decomposition of complex lignin polymers. Therefore, the existence and abundance of this phylum can be a natural or unnatural indicator of the forest condition [4].

As 300,000 species of Basidiomycota mushrooms have been known [5]. Similar research results found 17 species of macrofungi in the Arboretum protected forest area and 12 species found in the open forest area of the former burning forest of Kalampangan, Central Kalimantan [6]. Based on the role of the Basidiomycota mushroom as an indicator of forest wisdom, the exploratory dominance of the ethnomicology of the Basidiomycota fungus in Central Kalimantan needs to be done, with the purpose to document the biodiversity of open forests in Central Kalimantan.

2. Methods

The study was conducted in May to October 2019 in four open forest locations, namely the Tanjung Sanggalang Katingan forest area, the North Barito Lahei forest area, the South Sanggu Barito forest, the East Barulan Sampulan forest area, Central Kalimantan. Data collection was carried out by collecting primary data followed by the identification of samples in the laboratory. The research method used a survey method with a single plot technique measuring 20x20m and the laying of the plot by purposive sampling with following mushrooms. The technique of preparation of mushroom fruit body specimens found was calculated in the total number of fruit bodies, some of them collected by wet preserving technique [7]. Meanwhile, morphological identification of specimens refers to the mushroom identification book [8]. Ethnomicological study data used interview methods with four key informants from the local population, related to the use of mushrooms for consumptive purposes and their use as medicine.

3. Results and discussion

3.1. Description of data

According to data on the village profile that the Tanjung Sangalang Katingan forest area only has an area of around 5.4 ha. North Lahei Barito forest area is 302,357.62 Ha / Km 2, covering Protection Forest (PF) covering 13,812.38 ha / Km 2, Production Forest (PF) covering 112,232.39 Ha/Km 2, Convertible Production Forest (CPF) covering an area of 31,293.08 Ha/ Km 2 and Limited Production Forest (LPF) covering an area of 144,019.77 Ha/Km 2. South Sanggu Barito forest area 1140 Ha/Km^2, limited forest 1000 ha / Km^2, conservation forest 4668 Ha/Km^2 and small-holder private forest 2000 Ha/Km^2, production forest 500 Ha in good condition and 100 ha of damaged condition. East Sampulan Barito forest area only has an area of around 5 hectares, because settlements dominate it.

The description of the identification data in the field showed that the Basidiomycota mushroom fruit body was quite varied, namely from the morphology of the fruit body stalk length, the color and thickness of the gleba, and the shape and color of the spores both when young and old. Tanjung Sanggalang Katingan forest area found 14 species with 318 fruit bodies, North Lahei Barito forest found 54 species with 1471 fruit bodies, South Sanggu Barito forest found 27 species with 1344 fruit bodies, and East Sampulan Barito forest found 25 species with 682 fruit bodies. The details are presented in Table 1 below:

Table 1. Diversity of Basidiomycota Fungus.

No.	Species / Genus	Habitus	Number of Individuals	Type Habitus
1.	*Coltricia cinnamomea*	Plant	27	Sanggalang Katingan Forest Area
2.	*Coltricia sp*$_1$	Plant	42	
3.	*Coltricia sp 2*	Plant	17	
4.	*Coltricia sp* $_3$	Plant	22	
5.	*Clitoybe dealbata*	Soil	18	
6.	*Gaereapatum Stereum*	Plant	25	

Table 1. Cont.

7.	*Fomes* sp$_1$	Plant	21	North Barei Lahei Forest Area
8.	*Fomes* sp 2	Plant	43	
9.	*Ganoderma* sp$_1$	Soil	27	
10.	*Ganoderma* sp$_1$	Soil	15	
11.	*Ganoderma* sp 3	Soil	18	
12.	*Lactarius sp*	Soil	11	
13.	*Lentinus sp*	Plant	24	
14.	*Pseudotrametes* sp	Plant	8	
15.	*Auricularia polytricha*	Plant	28	
16.	*Austroboletus mutabilis*	Plant	34	
17.	*Boletus* sp$_1$	Plant	36	
18.	*Boletus* sp 2	Plant	32	
19.	*Boletus* sp 3	Plant	39	
20.	*Boletus* sp 4	Plant	29	
21.	Boletus sp 5	Plant	31	
22.	Boletus sp 6	Plant	34	
23.	*Clavulinopsis laeticolor*	Plant	37	
24.	*Collybia cirhata*	Plant	25	
25.	*Daedalea*	Plant	43	
26.	*Daedanilla*	Plant	38	
27.	*Ganoderma* sp 1	Soil	42	
28.	*Ganoderma* sp 2	Soil	30	
29.	*Ganoderma* sp 3	Soil	31	
30.	*Hebeloma* sp	Plant	28	
31.	*Hypholoma* sp	Plant	25	
32.	*Inocybe* sp	Plant	44	
33.	*Lactarius* sp$_1$	Soil	39	
34..	*Lactarius* sp$_2$	Soil	22	
35.	*Lycoperdon perlatum*	Soil	34	
36.	*Marasmius* sp$_1$	Plant	27	
37.	*Marasmius* sp 2	Plant	43	
38.	*Marasmius* sp 3	Plant	37	
39.	*Marasmius* sp 4	Plant	28	
40.	*Marasmius* sp 5	Plant	37	
41.	*Marasmius* sp 6	Plant	25	
42.	*Marasmius* sp 7	Plant	49	
43.	*Marasmius* sp 8	Plant	32	
44.	*Marasmius haematocephalus*	Plant	41	
45.	*Marasmius Oreades*	Plant	42	
46.	*Mycena* sp$_1$	Plant	6	
47.	*Mycena* sp 2	Plant	27	
48.	*Mycena* sp 3	Plant	32	
49.	*Mycena clavularis*	Plant	34	
50.	*Mycena lilacipolia*	Plant	28	
51.	*Panus* sp$_1$	Plant	13	
52.	*Panus* sp 2	Plant	17	
53.	*Phiolita mutabilis*	Plant	11	
54.	*Phiolita* sp	Plant	12	
55.	*Pluteus atromarginatus*	Plant	16	
56.	*Polyporus* sp$_1$	Plant	32	
57.	*Polyporus* sp 2	Plant	21	
58.	*Polyporus* sp 3	Plant	14	
59.	*Polyporus* sp 4	Plant	12	
60.	*Polyporus* sp$_5$	Plant	10	
61.	*Polyporus* sp 6	Plant	12	

Table 1. Cont.

62.	*Pycnoporus sanguinis*	Plant	13	
63.	*Ramaria* sp1	Plant	16	
64.	*Ramaria* sp 2	Plant	10	
65.	*Russula* sp	Plant	19	
66.	*Russula subniricans*	Plant	13	
67.	*Thelephora* sp	Plant	21	
68	*Tremella* sp	Plant	20	
69.	*Fomes* sp 1	Plant	61	
70.	*Fomes* sp 2	Plant	52	
71.	*Fomes* sp 3	Plant	47	
72.	*Fomes* sp 4	Plant	50	
73.	*Fomes* sp 5	Plant	58	
74.	*Fomes fentarius*	Plant	45	
75	*Coltricia cinnamomea*	Plant	42	
76.	*Coltricia* sp1	Plant	46	
77.	*Coltricia* sp 2	Plant	41	
78.	*Coltricia* sp 3	Plant	54	
79.	*Coltricia* sp 4	Plant	58	
80.	*Coltricia* sp 5	Plant	37	
81.	*Lenzites betulina*	Plant	48	
82.	*Lenzites* sp	Plant	51	
83.	*Ganoderma boninse*	Plant	34	
84.	*Ganoderma* sp 1	Plant	41	
85.	*Ganoderma* sp 2	Plant	57	
86.	*Hypholoma marginatum*	Soil	42	
87.	*Stereum gausapatum*	Plant	45	
88.	*Stereum* sp	Plant	38	
89.	*Clitoybe* sp	Soil	52	
90.	*Clitoybe dealbata*	Soil	47	
91.	*Lactarius sp*	Soil	41	
92.	*Boletus* sp	Plant	36	
93.	*Pynoporus cinnabarinus*	Plant	37	
94.	*Rudicidal Panels*	Plant	41	
95.	*Auricularia polytricha*	Plant	43	
96.	*Pleurotus ostreatus*	Plant	37	
97.	*Pluteus atromarginatus*	Plant	32	
98.	*Pleurotus* sp.	Plant	27	
99.	*Lactarius sp*	Soil	37	
100	*Lactarius corrugis*	Soil	42	
101	*Laetiporus sulphureus*	Plant	28	
102	*Fomes* sp.	Plant	23	
103	*Lactarius obscuratus*	Soil	24	
104	*Russula nobilis*	Soil	25	
105	*Amanita atrodisca*	Soil	25	
106	*Amanita citrine*	Plant	21	
107	*Polyporus cinnabarinus*	Plant	31	
108	*Poria* sp.	Plant	28	
109	*Fomes* sp.	Plant	25	
110	*Coltricia cinnamomea*	Plant	27	
111	*Auricularia polytricha*	Plant	28	
112	*Coprinus lagopus*	Plant	20	
113	*Lycoperdon perlatum*	Soil	21	
114	*Lactarius rubidus*	Soil	31	
115	*Polyporus* sp.	Soil	24	

Sanggu Barito Selatan Forest Area

Sampulan East Barito Forest Area

Table 1. Cont.

116	*Hygrocybe calciphila*	Soil	27
117	*Ramaria myceliosa*	Soil	38
118	*Clavaria rosea*	Soil	20
119	*Cantharellus* sp.	Plant	14
120	*Coprinus ephemerus*	Plant	27

In total, 3.715 mushroom fruit bodies from 120 species and 41 genera were found, of which 94 species were known to have a habitat in other plants as ectomycorrhizae, while 26 species grew above ground level (Table 1).

3.2. Distribution of fungi by genus

The distribution of 41 genera of the Basidiomycota fungus found was dominated by the genus *Coltricia* (67.5%), *Marasmius* (25%) and *Fomes* (25%). While it base the distribution on the number of individual species *Fomes* sp (425 fruit bodies) and *Colricia* (413 fruit bodies) which are more dominant than the others, as the following diagram:

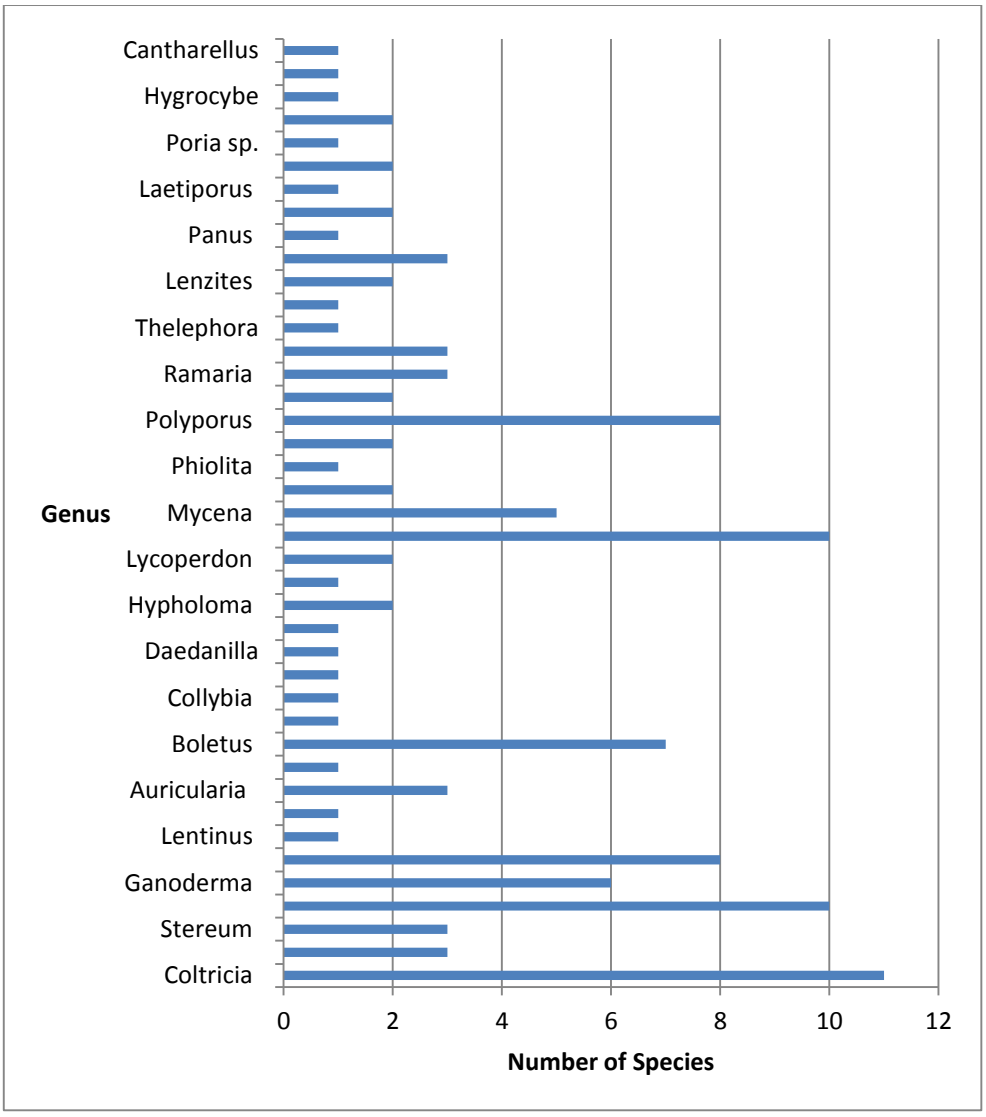

Figure 1. Distribution of fungi by genus.

Distribution data by genus illustrate diversity. Basidiomycota diversity data ontained in this study were higher when compared to previous studies (Figure 1). The number of mushroom species found was 44 species of mushrooms in the seed stand Dipterocarpaceae in Sebangau National Park and Tanjung Puting National Park in Central Kalimantan [9], and 32 species of fungi from 15 families in the Bukit Beluan forest of Kapuas Hulu District, Central Kalimantan [10]. The difference is likely influenced by the area of study, and differences in climatic factors or availability of different substrates and hosts.

Climate factors and the availability of vegetation and human activities as natural users have a great influence on local wisdom and natural resources, including the diversity of fungi [11]. It classified the level of diversity of mushroom species in this study as moderate, with a Margalef species wealth index (*R*') of 3.15, Simpsons Index (*D*') of 0.68 and the Shannon-Wienner Index (*H*') of 2.14. Likewise, based on the level of evenness, the species is classified as moderate with an evenness index (*E* ') of 0.73. Human activities in their use of natural resources affect the diversity of species, such as land clearing and burning of forests, cleaning litter under its stand, climatic conditions such as hot temperatures and relatively less rainfall.

Data collection in the form of mushroom fruit body collection in several species could not be done, because it was constrained in the long dry season and rainfall was very lacking. Environmental conditions such as dry and hot, the intensity of rain and the time of observation are very important to consider seeing the diversity of fungi because these external conditions can affect the development of fruit bodies found [12]. This also determines the condition of the habitat [13].

3.3. Ethnomicology

Based on the study of ethnomicology information obtained 5 species of mushrooms that are commonly consumed by local communities, such as, cloud ear fungus (Auricularia polytricha), Oyster Mushroom (*Pleurotus ostreatus*), *Hygrocybeal calc*, *Cantharellos*, and Common Puffball (*Lycoperdon pertatum*). For the fungus as an ingredient in the treatment of disease, 2 types were found, namely *polyporus cinnabarius* and *ganoderma*. It was found that *polyporus cinnabarius* was used by the community as a drug for ulcers, and *ganoderma* as a drug for digestive tract infections and coughing. How to use *polyporus cinnabarius* as a traditional medicine of local people for boil is made by grinding and sticking to the therapeutic object, while *ganoderma* as a drug for digestive infections and cough is by boiling and then consuming it. Some types of mushrooms that are consumed by the local Dayak community are medicinal plants, as the Kenyah Dayak tribe also uses medicinal local plants, one of which is a reproductive health medicine for women [14].

Based on literature studies, it is known that *Pleurotus ostreatus* and *Ganoderma* has β-glucans polysaccharide compounds with long chains that act as food fibers. This compound will interact with blood fat, so it can reduce blood cholesterol levels [15]. Besides, β-glucans can also form viscous substances that prolong gastric emptying, inhibit the transfer of triglycerides and cholesterol in the intestine, and reduce the absorption of LDL (low-density lipoprotein). β-glucan can also bind bile acids, monoglycerides, free fatty acids, and cholesterol [16].

4. Conclusion

The study found 3,715 Basidiomycota mushroom fruit bodies from 120 species, of which 94 species had ectomycorrhizal symbiosis in plants and 26 species grew above ground level, with moderate species diversity. The total genus distribution was 41 genera, where the genus *Coltricia* (67.5%) was more dominant than the other genera. Individuals are dominated by the species *Fomes* (425 fruit bodies) and *Coltricia* (413 fruit bodies). *Marasmius* (25%), and *Fomes* (25%) were more dominant than others. Based on the study of ethnomicology information obtained 5 species of mushrooms that are commonly consumed by local communities, such as, cloud ear fungus (*Auricularia polytricha*), Oyster Mushroom (*Pleurotus ostreatus*), *Hygrocybeal calc*, *Cantharellos*, and Common Puffball (*Lycoperdon pertatum*). For the fungus that an ingredient in the treatment of disease, 2 types are found, namely *Polyporus cinnabarius* and *Ganoderma*. This study was expected to a reference for the development and cultivation of mushrooms, as one source of local wisdom.

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