Diversity of Macroscopic Fungi in The Environment of Universitas Negeri Gorontalo

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Abstract. This research was conducted to characterize, know the types and find out the index of diversity of macroscopic fungi found on campus 4, Universitas Negeri Gorontalo. The method used in this research is an exploratory survey, namely direct observation at the research location. Data collection using roaming techniques, home ranges were carried out throughout the study. The results showed the fungis found consisted of 2 divisions, 4 classes, 9 orders, 26 families, 40 genera and 67 species and had a diversity index H'= 1.55 which means it has a medium category diversity index value.

Keywords: diversity, macroscopic, fungi

1 Introduction

Macroscopic fungi are a group of organisms that do not have chlorophyll so they obtain their food by absorbing organic substances in their environment by secreting lignicellulose enzymes [1] [2]. The ability to absorb these substances makes fungis a very beneficial organism for the environment and humans [3]. In the macroscopic environment, fungi act as decomposers [4] [5] [6] which help the cycle of matter in nature [7], affect food webs, affect plant survival and germination and affect the whole forest health [2] [8]. For humans, fungis have been used as food ingredients, herbal drinks and have potential as cosmetic ingredients [9] [10].

Macroscopic fungi usually live on dead wood that has been weathered [11]. Microscopic fungi are found in various types of habitats, depending on the species composition of trees and other substrates [12], in addition, microscopic fungi can be found on land in the tropics [13]. Areas with a rainy climate are areas suitable for macroscopic fungi growth [14]. Macroscopically, the fungus has a large, conspicuous spore-bearing structure and has a hard, fleshy umbrella-like sporophore that bears a holobasidium on the surface of the lamellae that hang from the cap [12].

Fungus requires a moist environment for its growth. Fungis can grow at temperatures above 20∘c, humidity 60-90%, light intensity 60-70% and live at pH

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4-9. Good areas for fungi growth are forests or watersheds (DAS), swamp areas or lakes that have humid environmental conditions with little light intensity.

Currently research on macroscopic fungi diversity in several areas is still very minimally carried out, including information on macroscopic fungi diversity in the campus environment. One of the campuses that has the potential for macroscopic fungi is campus 4, Universitas Negeri Gorontalo. Campus 4 of Universitas Negeri Gorontalo is a campus which was inaugurated in 2019. Campus 4 of Universitas Negeri Gorontalo is a campus located in Bone Bolango district, Kabila District, Moutong Village. The land area is ± 32 Ha with various types of vegetation and various environmental conditions in it. Campuses 4 of Universitas Negeri Gorontalo have forest areas that are still maintained, have hilly areas and swamp areas. In it there is also a small river that empties into the Bone river. The results of observations of the campus 4 environment at Universitas Negeri Gorontalo had temperatures above 20∘c, humidity above 51%, light intensity above 191 lux and pH above 4.5. These diverse physical conditions and vegetation allow for the growth of a wide variety of macroscopic fungi.

Campus 4 of Universitas Negeri Gorontalo is a campus that is still relatively new. The development process continues to be carried out to support the lecture process so that it runs well. Development that continues to be carried out will threaten the existence of macroscopic fungus species that exist on campus 4 of Universitas Negeri Gorontalo. Macroscopic fungi research on campus 4 at Universitas Negeri Gorontalo has never been done. Until now there is no information or data base on the types of macroscopic fungi found in Campus 4, Universitas Negeri Gorontalo. So this research needs to be done to characterize and find out the types of macroscopic fungi found in the campus environment of Universitas Negeri Gorontalo.

2 Method

2.1 Tools and Materials

The tools and materials used in the research are as follows: 1) Writing tools to record things needed during research, 2) Camera as a documentation tool in research, 3) GPS to find coordinates when taking samples, 4) Tweezers are used to take research fungi samples, 5) Knife, used to take samples attached to the substrate, 6) Jars are used to place samples to be identified, 7) Thermometers are used to measure temperature, 8) Lux meters are used to measure light intensity, 9) Thermo- A hygrometer is used to measure air humidity, 10) Soil Tester to measure soil moisture, 11) Label paper to label the fungi jars obtained, 12) Macroscopic fungis as research samples.

2.2 Methods

This research uses an exploratory survey method, namely making direct observations at the research location. Data collection uses roaming techniques.

The exploration technique is carried out by exploring the entire campus area of Gorontalo State University 4. The data that has been obtained is analyzed quantitatively descriptively. Identification is carried out using the identification guidebook "Psilocybin Mushrooms of the World: An Identification Guide", using the automatic mushroom identification application. Apart from that, identification is carried out using the mushroom identification-Automatic application and the website https://www.mycobank.org/ and https://www.gbif.org/. The macroscopic fungi obtained were calculated for their diversity index quantitatively using the Shannon-Wienner diversity index formula [15] with the formula:

$$H' = -\sum_{i=1}^{S} P_i \ln P_i$$

$$P_i = \frac{N_i}{N}$$

where:

- H' = Diversity index (Shannon-Wiener)
- N_i = Number of individuals in one species
- N = Total number of individuals from all species
- ln = Natural logarithm
- S = Number of species

Diversity criteria based on H' values:

- $H' < 1$ = Low diversity
- $1 < H' < 3$ = Medium diversity
- $H' > 3$ = High diversity

3 Result and Discussion

Table 1, shows the information related to research variables. Variable Y is a response variable that is the period of treatment of the patient. Furthermore, there are 8 predictor variables, namely X1 Age, X2 gender, X3 indications of tightness, X4 indications of Cough, X5 Indications of fever, X6 previous history of TB, X7 Occupation, and X8 smoking.

The results of the identification of macroscopic fungi in the campus 4 environment showed that the fungal species found consisted of 2 divisions, 4 classes, 9 orders, 26 families, 40 genera and 67 species. The overall identification results can be seen in table 1 below:

Table 1: Results of Identification of Macroscopic Fungi on Campus 4, Universitas Negeri Gorontalo

Class	**Order**	**Family**	**Species**
Sordariomycetes	Xylariales	Xylariaceae	*Daldinia concentrica*
Pezizomycetes	Pezizales	Sarcoscyphaceae	*Sarcoscypha coccinea*
Agaricomycetes	Agaricales	Agaricaceae	*Leucocoprinus cretaceous*
			Leucocoprinus cepaestipes
			Leucocoprinus ianthinus
			Agaricus campestris
			Leucoagaricus leucothites
			Macrolepiota dolichaula
	Hymenogastraceae		*Psilocybe cubensis*
	Omphalotaceae		*Gymnopus dryophilus*
			Gymnopus johnstonii
			Gymnopus quercophilus
	Psathyrellaceae		*Parasola plicatilis*
			Parasola Redhead
			Coprinellus disseminatus
			Coprinellus impatiens
			Coprinellus micaceus
			Coprinellus domesticus
			Coprinellus flocculosus
			Coprinopsis lagopus
			Candolleomyces candolleanus
			Psathyrella spadiceogrisea
			Panaeolus semiovatus
	Marasmiaceae		*Marasmius rotula*
			Marasmius calhouniae
			Marasmius haematocephalus
	Schizophyllaceae		*Schizophyllum commune*
			Schizophyllum egalingium
	Lycoperdaceae		*Bovista plumbea*
			Lycoperdon perlatum
	Tricholomataceae		*Delicatula integrella*
	Strophariaceae		*Stropharia semiglobata*
	Mycenaceae		*Mycena acicula*
	Lyophyllaceae		*Termitomyces microcarpus*
	Amanitaceae		*Amanita virosa*
	Strophariaceae		*Gymnopilus dilepsis*
	Physalacriaceae		*Hymenopellis gigaspora*
	Pluteaceae		*Volvariella volvacea*
	Hydnangiaceae		*Laccaria laccata*
Polyporales	Ganodermataceae		*Ganoderma applanatum*

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Class	Order	Family	Species
			Ganoderma resinaceum
			Ganoderma lipsiense
			Ganoderma sessile
			Ganoderma Australia
			Ganoderma lingzhi
			Ganoderma lucidum
	Polyporaceae		*Microporus xanthopus*
			Polyporus tuberaster
			Polyporus brumalis
			Polyporus arcularius
			Lentinus flexipes
			Lentinus polychrous
			Lentinus tigrinus
			Lentinus squarrosulus
			Trametes elegans
			Trametes sanguinea
			Trametes gibbosa
			Trametes pubescens
			Trametes polyzona
			Daedaleopsis confragosa
			Pycnoporus cinnabarinus
	Incrustoporiaceae		*Tyromyces chioneus*
Phallales	Phallaceae		*Mutinus argentinus*
Auriculariales	Auriculariaceae		*Auricularia auricula-judae*
Cantharellales	Hydnaceae		*Cantharellus cibarius*
Russulales	Hericiaceae		*Hericium coralloides*
Dacrymycetes	Dacrymycetales	Dacrymycetaceae	*Dacryopinax spathularia*

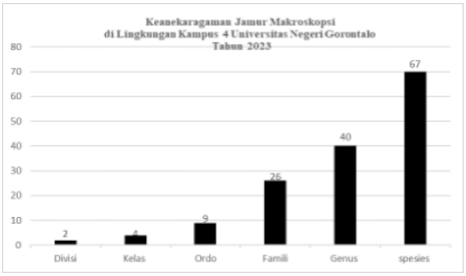

Fig. 1. Diversity of macroscopic fungi of campus 4 Universitas Negeri Gorontalo

Based on Figure 2, the most common types of fungis found were the omphalotaceae family with a total of 8748 species. The predominant type isGymno-

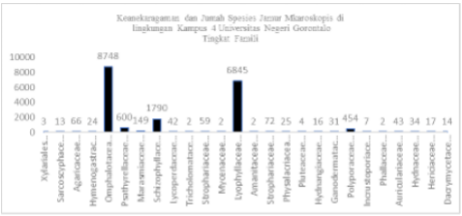

Fig. 2. Diversity of macroscopic fungi family levels in Campus 4, Universitas Negeri Gorontalo

pus johnstoniiwhich is an annual fungi that grows in the rainy season. The types of fungis obtained in small quantities were Tricholomataceae, Amanitaceae, Mioenaceae and Phallaceae, each of which only had 2 species.

Table 2: Diversity Index of Macroscopic Fungi at Campus 4 of Universitas Negeri Gorontalo

Species	**Total Number of Species**	**Pi.Ln pi**
Leucocoprinus cretaceous	2	-0.0010
Leucoagaricus leucothites	32	-0.0107
Marasmius rotula	2	-0.0010
Ganoderma applanatum	11	-0.0043
Ganoderma resinaceum	2	-0.0010
Ganoderma lipsiense	4	-0.0018
Ganoderma sessile	2	-0.0010
Psilocybe cubensi	24	-0.0084
Agaricus campestris	22	-0.0078
Parasola plicatilis	73	-0.0213
Microporus xanthopus	73	-0.0213
Gymnopus dryophilus	122	-0.0323
Coprinellus disseminatus	25	-0.0087
Polyporus tuberaster	2	-0.0010
Schizophyllum commune	1607	-0.2085
Tyromyces chioneus	7	-0.0029
Gymnopus johnstonii	8570	-0.3594
Bovista plumbea	35	-0.0116
Lentinus flexipes	18	-0.0066
Lentinus polychrous	27	-0.0093
Delicatula integrella	2	-0.0010
Coprinopsis lagopus	73	-0.0213
Lentinus tigrinus	27	-0.0093
Stropharia semiglobata	59	-0.0179
Candolleomyces candolleanus	7	-0.0029

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Species	**Total Number of Species**	**Pi.Ln pi**
Parasola plicatilis	123	-0.0325
Coprinellus impatiens	14	-0.0053
Mutinus argentinus	2	-0.0010
Trametes elegans	28	-0.0096
Schizophyllum commune	183	-0.0446
Mycena acicula	2	-0.0010
Leucocoprinus cepaestipes	2	-0.0010
Polyporus brumalis	4	-0.0018
Termitomyces microcarpus	6845	-0.3678
Amanita virosa	2	-0.0010
Daedaleopsis confragosa	37	-0.0121
Ganoderma australia	3	-0.0014
Marasmius calhouniae	82	-0.0234
Psathyrella spadiceogrisea	124	-0.0328
Polyporus arcularius	14	-0.0053
Auricularia auricula-judae	43	-0.0138
Trametes sanguinea	4	-0.0018
Daldinia concentrica	3	-0.0014
Macrolepiota dolichaula	2	-0.0010
Cantharellus cibarius	34	-0.0113
Dacryopinax spathulari	14	-0.0053
Gymnopilus dilepsis	72	-0.0211
Coprinellus micaceus	35	-0.0116
Coprinellus domesticus	123	-0.0325
Coprinellus flocculosus	2	-0.0010
Trametes gibbose	19	-0.0069
Marasmius haematocephalus	56	-0.0171
Hymenopellis gigaspora	25	-0.0087
Lentinus squarrosulus	162	-0.0405
Sarcoscypha coccinea	13	-0.0050
Trametes pubescens	8	-0.0033
Ganoderma lingzhi	7	-0.0029
Ganoderma lucidum	2	-0.0010
Pycnoporus cinnabarinus	23	-0.0081
Panaeolus semiovatus	2	-0.0010
Volvariella volvacea	4	-0.0018
Gymnopus quercophilus	56	-0.0171
Total	**19057**	**H'=1.55**

The macroscopic fungi that have been obtained are calculated for their diversity index using the Shannon-Wienner formula and obtainedthat the diversity index of macroscopic fungi in the 4 campus environment of Universitas Negeri Gorontalo is with an H' value (Diversity index) = 1.55. This value indicates

that the index of macroscopic fungi diversity in the campus 4 environment of Universitas Negeri Gorontalo is in the medium category. This is in line with the theory put forward by [16], that if the value is 1<H'<3 then the diversity index is medium. More clearly this value can be seen in Table 2.

The index of macroscopic fungi diversity in the campus environment of Universitas Negeri Gorontalo is being (H'= 1<3) caused by uneven distribution of fungi where certain types of fungi are found in large quantities, such as at several locations close to swamp areas and forest cover, but some were found in very small quantities such as open areas in front of the library and beside the Faculty of Letters and Culture. Environmental factors also greatly influence the growth of macroscopic fungi. Several factors influence such as air temperature, air humidity, soil pH and light intensity. This is in line with (Leluni, 2020) which explains that environmental factors that affect the number of fungi in nature are temperature, pH and humidity and light intensity. According to Soerianegara [17] moderate diversity is caused by repeated changes in vegetation and the presence of nutrients, light, and water obtained by a vegetation, so that the shape and number of plant species matches where they grow. Another factor affecting the diversity of macroscopic fungi in the 4 campuses of Universitas Negeri Gorontalo is human activity. Campus 4, which is still under construction, is still carrying out a lot of land clearing which has an impact on the loss of macroscopic fungi species found in the research location. Another factor affecting the diversity of macroscopic fungi in the 4 campuses of Universitas Negeri Gorontalo is human activity. Campus 4, which is still under construction, is still carrying out a lot of land clearing which has an impact on the loss of macroscopic fungi species found in the research location. Another factor affecting the diversity of macroscopic fungi in the 4 campuses of Universitas Negeri Gorontalo is human activity. Campus 4, which is still under construction, is still carrying out a lot of land clearing which has an impact on the loss of macroscopic fungi species found in the research location.

4 Conclusion

According to the research's results of the estimated parameters of the regression model with a weight least square and the interpretation that has been carried out, it can be concluded that if the TB patient-free variables such as Age (X_1), Indication of shortness of breath (X_3), Indication of Cough (X_4), and previous history of pulmonary TB (X_6) are of low value, it is estimated that the treatment period of the TB patient will also be low or the patient will recover faster.

References

1. D. Asri, Fungal Biology Journal **8**, 123 (2022)
2. A. Munir, *Fungal Ecology and Environment* (Nature Books, 2006)
3. S. Rahmawati, Indonesian Journal of Biodiversity **25**, 200 (2018)
4. L. Ekamawanti, Tropical Ecology Journal **12**, 78 (2018)

5. M. Wati, Mycology Research Letters **10**, 55 (2019)
6. B. Arif, International Journal of Mycology **7**, 89 (2020)
7. D. Nasution, Biodiversity Conservation Journal **14**, 133 (2018)
8. R. Hasan, Plant-Fungi Interactions **19**, 210 (2022)
9. S. Liswidyawati, *Potential Uses of Fungi in Cosmetics and Medicine* (Health Science Press, 2012)
10. S. Parjimo, *Fungi as Food and Medicine* (Herbal Science Press, 2007)
11. M. Jaroszewicz, F. Sumarni, K. Anwar, Ecological Mycology **17**, 299 (2022)
12. e.a. Parveen, M., Journal of Mycological Studies **22**, 145 (2017)
13. e.a. Shuhada, F., Tropical Biology Research **12**, 65 (2020)
14. e.a. Alli, R., Environmental Science Journal **5**, 233 (2017)
15. A. Rozak, *Indeks Keanekaragaman Shannon-Wiener dan Penerapannya dalam Ekologi* (Penerbit Akademika, Jakarta, 2020)
16. M.F. Fachrul, *Metode Sampling Bioekologi* (Bumi Aksara, Jakarta, 2007)
17. I. Soerianegara, *Ekologi Hutan Indonesia* (IPB Press, Bogor, 2005)