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Macro Fungi Diversity in The Sanggabuana Mountain Area, Karawang Regency, Tegalwaru District, West Java

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Abstract

Sanggabuana Mountain is a mountain located within the territory of Karawang Regency. Administratively, the mountain is situated in Karawang Regency, Tegalwaru District, West Java. The height of the mountain is 1,291 meters above sea level (MDPL) and is the highest and only mountain in Karawang. The area has a high biodiversity, making it highly likely to find many macrofungi, especially macrofungi. This research was conducted to determine the diversity of macrofungi in the Sanggabuana Mountain area of Karawang Regency, Tegalwaru District, West Java. The type of research is exploratory and descriptive research, conducted on three observation routes; Route A (Cigentis), Route B (local plantations), and Route C (Kejayaan). The research results obtained a total of 23 species from 17 genera of macrofungi across the three observation routes, with the species diversity index in all three routes falling into the moderate diversity category. The highest encounter frequency of macrofungi on Route B was *Ganoderma applanatum* (23%), on Route A was *Trametes* sp (19%), and on Route C was *Microporus xanthopus*, *Xylaria* sp, and *Inonotus* sp (10%). The species dominance index on Route A falls into the high dominance category, while on Route B and C, it falls into the low dominance category.

Keywords: Diversity, Dominance index, Frequency, Macrofungi,

INTRODUCTION

Indonesia is one of the mega-biodiverse countries. This is due to Indonesia being blessed with high biodiversity and a very high level of ecological and organism endemism (uniqueness). One of the biodiversity found in Indonesia is fungi. Fungi are eukaryotic organisms, spore-bearing, non-chlorophyllous, reproducing both sexually and asexually. Based on their body size, there are macroscopic fungi, which are large enough to be seen with the naked eye, and microscopic fungi, which are small and can only be seen using a microscope (Darwis et al., 2011).

Fungi generally inhabit various types of habitats such as soil, wood, litter, animal droppings, and so on. Forest ecosystems can be inhabited by fungi because forests have high humidity levels, making it easy for fungi to adapt (Darwis et al., 2011). The global presence of fungi is estimated to reach 1.5 million species that are predicted to still be alive (Solle et al., 2017).

Fungi obtain food or nutrients using a structure consisting of fine threads called hyphae (Anggriawan, 2014). Fungi acquire food by absorbing nutrients from the external environment. This is done by secreting hydrolytic enzymes into their surroundings. These enzymes break down complex molecules into smaller organic compounds that can be absorbed into their bodies (Campbell et al., 2012).

Fungi play a crucial role in the life cycle (Purwanto, 2017). Fungi have an important role in ecosystems, acting as decomposers and balancing forest species diversity. Decomposers are organisms capable of breaking down dead organic matter into water, carbon dioxide, minerals, and other simple chemicals that can be recycled by green plants. The dead organic matter can be in the form of leaf litter, dead wood, animal carcasses, or feces (Hasanuddin, 2014). Furthermore, Tampubolon (2010) stated that fungi, especially macro fungi groups from the Basidiomycota Phylum, can be used to indicate air quality, ecosystem health, and pollution effects.

Based on the latest classification, there are five groups of fungi: Chytridiomycota, Zygomycota, Glomeromycota, Ascomycota, and Basidiomycota (Purwanto, 2017). Proborini (2006) stated that the identification of fungi is done by observing the morphology of the fruiting body. Parameters used in fungi identification include (shape, color, and texture of the fruiting body, presence of ring and volva).

Sanggabuana Mountain is a mountain located in Karawang Regency. This area has a high biodiversity, making it highly likely to find many fungi, especially macrofungi. The presence of fungi, especially macrofungi, in the area, has not yet been reported. Based on the background above, this research is conducted to determine the diversity of fungi in the Sanggabuana Village area, Karawang Regency, Tegalwaru District, West Java.

METHOD

A. Study Site

This research was conducted from September 10th to 15th, 2023. Data collection was carried out in forest areas, gardens, and residential areas in the Sanggabuana region, Karawang Regency, Tegalwaru District, West Java (Figure 1).

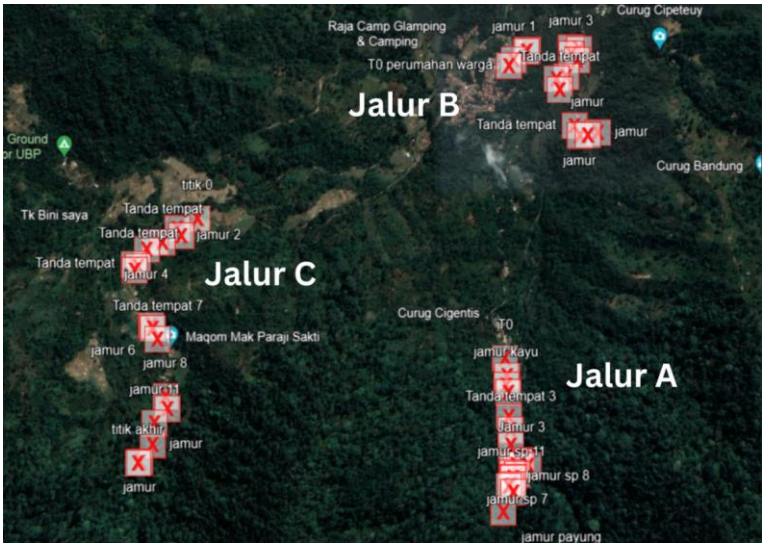

Figure 1. Route A (Cigentis), Route B (local plantations), Route C (Kejayaan)

B. Materials and Tools

The tools used in this research include writing tools, data tabulation sheets, road signs, luxs meter, thermometers, a pH meter, a thermohygrometer, GPS (Global Positioning System), a scalpel,

tweezers, a Bunsen burner, and books for identifying fungi. The materials used in this research are sterile distilled water, slanted PDA (Potato Dextrose Agar) media, spirit, and 70% alcohol.

C. **Procedure**

1. Data Collection

Data collection was carried out through exploration, which involved searching for macrofungi in the forest and local plantations of Sanggabuana Village, Tegalwaru District, Karawang Regency, West Java.

2. Observation of Fruiting Body Morphology

Macro Fungi samples found at the research site were observed and recorded for their morphological characteristics. Photographs of the fungi were taken using a camera. Morphological observations were conducted using a descriptive method. The macrofungi samples found in the field were observed for fruiting body shape, size, color, texture, life characteristics (solitary or colony), number of individuals or colonies, and growth substrate (live or dead tree branches, soil, litter, or other substrates).

3. Measurement of Environmental Factors

The environmental factors recorded were air temperature, soil pH, air humidity, and light intensity. Data collection for these environmental factors was taken from morning encounters, starting from 7 a.m. until 12 p.m.

4. Macro Fungi Identification

Macro fungi identification was conducted based on data from field observations and further observations in the laboratory. The obtained data was then matched with macrofungi identification books until the species name was identified.

D. Research Design

1. Species Diversity

To determine the species diversity index of fungi, the Shannon-Wiener formula (Maguran, 1987) was used.

$$H' = \sum_{i=1}^{S} (pi)(1n\ pi)$$

Explanation:
H = Shannon-Wiener Diversity Index
Pi = Number of individuals of a species / total number of all species
Ni = Number of individuals of species i
N = Total number of individuals

Table 1. Classification of Shannon-Wiener Diversity Index Values (H')

Shannon-Wiener Index Value.	Category
> 6,907	High diversity, high distribution of individuals per species, and high community stability.
2,302 - 6,907	Moderate diversity, moderate distribution of individuals per species, and moderate community stability.
0 - 2,302	Low diversity, low distribution of individuals per species, and low community stability.

2. Frequency of Occurrence

The frequency to determine the encounter rate of each number of fungal species in a single habitat is calculated using the formula: (Juniami, 2014)

$$\text{Frequency (F)} = \frac{\text{Number of observation plots containing the species}}{\text{Total number of plots}}$$

Relative Frequency (FR) = (Frequency (F)) / (Total frequency of all species) × 100%

3. Dominance Index (D)

The dominance index is used to assess the level of dominance of a particular biota group. If D decreases, the value of H' will also decrease, indicating the dominance of one species over others. The magnitude of dominance will lead the community condition to become unstable or stressed. The formula used to determine the dominance index (Ludwig and Reynolds, 1988) is:

$$D = \sum (Ni / N)2$$

Explanation:
D = Simpson's Dominance Index

Table 2. Range of Simpson's Dominance

Simpson's Dominance Index	Category
$0,0 < D \leq 0,5$	Low dominance
$0,5 < D \leq 0,75$	Moderate dominance

0,75 < D ≤ 1	High dominance

RESULT

1. Influence of Environmental Conditions on Macro Fungi

Below are the environmental conditions in the three routes, including air temperature, pH, light intensity, and air humidity:

Table 3. Influence of Environmental Conditions on Macro Fungi

Observation Route	Air Temperature (°C)	pH	Light Intensity (Lux)	Air Humidity (%)
A	22	6	103 – 6400	70
B	27	7 – 8	406– 12420	20 – 80
C	24	7- 8	183– 47300	10 – 30

2. Diversity of Macro Fungal Species

The differences in the diversity index of each location can be seen in Figure 2.

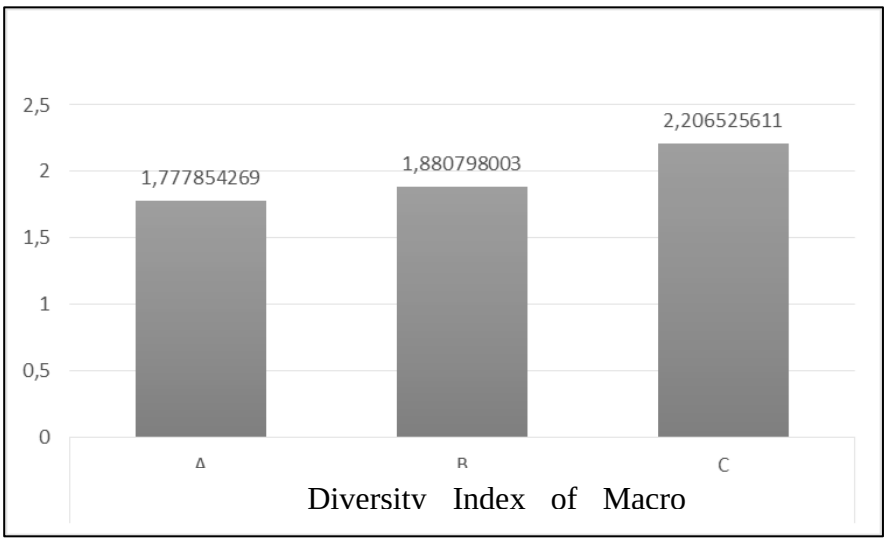

Figure 2. Diversity Index of Macro Fungi

3. Frequency of Macro Fungal Presence

Frequency of presence is one of the determinants to ascertain the number of a macro fungus growing in its natural habitat. The frequency of macrofungal presence differs in each route (Figure 3).

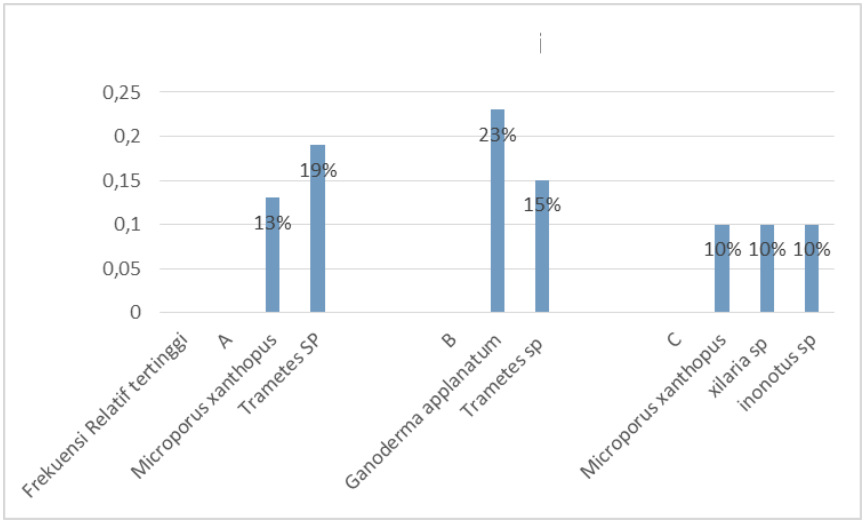

Figure 3. Bar Chart of Frequency Index

4. Dominance Index of Macro Fungi

Dominance Index of Macro Fungi. The dominance index of macrofungi varies in each route (Figure 4).

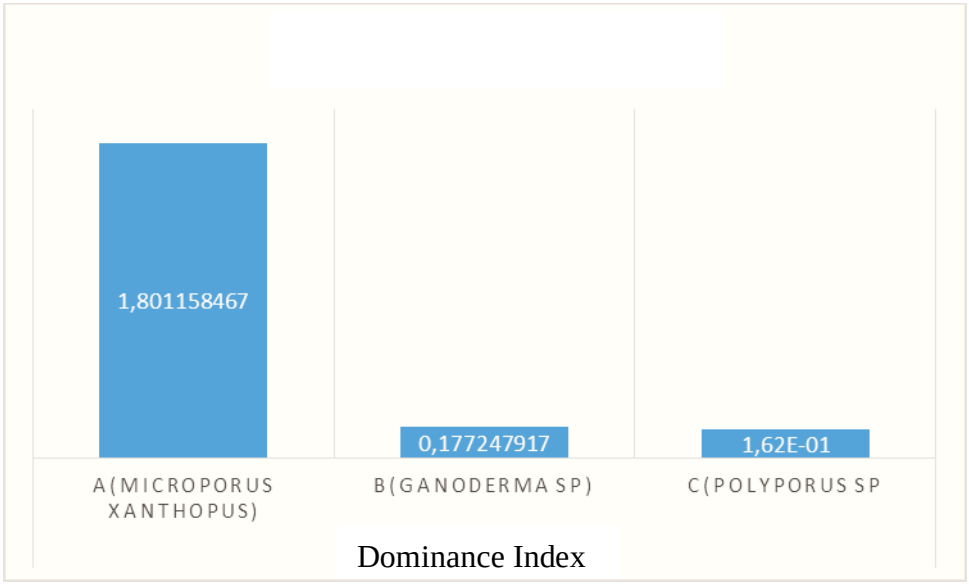

Figure 4. Bar Chart of Dominance Index

DISCUSSION

Table 3 shows the environmental conditions in the observation routes. Based on the observations conducted, the environmental conditions at the observation sites vary greatly. Some conditions are still supportive for fungal growth, such as temperature. However, a pH of 7-8, high light intensity, and low humidity are not very conducive to fungal growth. This is because the environmental conditions during the study were during a long dry season, very hot, with dry soil and many dead trees reducing the canopy. This high light intensity affects soil humidity and pH. Environmental conditions significantly influence fungal diversity because fungi grow in moist and shaded environments. If the environment is open and not humid, fungi will not grow there, resulting in low fungal diversity in such environments. Fungi require humidity for growth, ranging between 80% - 85% (Arini, 2016). Fungi can grow well in both cold and hot climates with an optimum temperature between 20 – 28ºC.

The temperature in routes A and C tends to approach the optimum temperature because these routes have denser canopies, making them cooler. Meanwhile, route B has a slightly higher temperature due to its more open canopy, making it warmer.

The acidity level (pH) in some observation routes approaches the optimum pH for fungal growth, which is between 5 and 7 and is lowest at pH 10. This indicates that fungi have different physiological characteristics based on the environmental factors of their habitat (Hakim, 2020).

The light intensity differs on each route. Route A has a light intensity ranging from 103 – 6400 lux, route B from 406-12420 lux, and route C from 183 – 47300 lux. Based on the observations conducted, route A has the lowest light intensity compared to routes B and C. This is because route A has a denser canopy, reducing the amount of light entering. Air humidity for route A tends to be high due to its proximity to a water source, while routes B and C tend to be low due to the ongoing dry season. Light intensity significantly affects fungal diversity because it can generate heat, increasing the temperature around the environment. Fungi grow in cooler environments, so high temperatures in the environment can significantly affect fungal diversity.

The diversity index aims to determine the diversity value of a region using the Shannon-Wiener test. The range of diversity index values (H') with the Shannon-Wiener test between 0 - 2.302 is considered low, H' between 2.302 - 6.907 is considered moderate, and H' greater than 6.907 is considered high. The diversity index of macrofungal species in the three routes can be seen in Figure 2.

When associated with the test, the diversity index in each route falls into the low category. This indicates that the distribution of the number of individuals per species and community stability is low. The diversity index values of fungi in the three routes vary. Route A has the lowest diversity index at 1.777. Route B has an index of 1.880, while Route C has the highest diversity index at 2.206. This is because more fungal species were found on Route C compared to Routes A and B.

The frequency of macrofungal presence varies in each route because each route (Route A, B, and C) has differences in several environmental factors that can affect the growth of macrofungi. Temperature, humidity, water content, and light intensity in nature influence fungal growth. The highest frequency is found on Route B with an encounter of the *Ganoderma applanatum* fungus species totaling 20. Route B is a suitable route for macrofungal growth, as many dead wood tree trunks are found, making it very suitable for growth. Meanwhile, Routes A and C have lower encounter frequencies of the *Ganoderma applanatum* fungus compared to Route B. The highest encounter frequency of fungi on Route A is Trametes sp at 19%, on Route B is *Ganoderma applanatu*m at 23%, and on Route C is *Microporus xanthop*us at 10%.

The Dominance Index is a parameter that indicates the level of species domination within a community. Dominance or species control in a community can be centralized on one species, several species, or multiple species, which can be estimated from the high or low value of the dominance

index (Indriyanto, 2015). In the graph, it can be observed that the highest dominance index of the three explored routes is found in Route A, and the lowest is in Route C. A smaller dominance index value indicates that no species dominates, whereas a larger dominance index value suggests the dominance of a specific species (Odum, 1993). Route A has a dominance index value of 1.8, categorizing it as having high dominance. Meanwhile, Routes B and C have a dominance index value of $0.0 < D \leq 0.5$, indicating low dominance for both routes.

In Route A (Cigentis), 13 mushroom species were found with the highest dominance index value of 1.8, categorizing Route A as having high dominance. Route A has a total of 428 mushroom individuals, with the most dominant species being Microporus xanthopus, with a count of 128 individuals.

In Route B (community plantation), 10 mushroom species were found with a dominance index value of 0.17, placing Route B in the low dominance category. Route B has a total of 118 mushroom individuals, with the most dominant species being Ganoderma sp, with a count of 30 individuals.

In Route C (Kejayaan), 18 mushroom species were found with a dominance index value of 0.16, categorizing Route C as having low dominance. Route C has a total of 283 mushroom individuals, with the most dominant species being Polyporus sp, with a count of 90 individuals.

CONCLUSION

After conducting the research "Diversity of Fungi in the Sanggabuana Mountain Area, Tegalwaru District, Karawang Sub-district, West Java", the following conclusions can be drawn:

1. A total of 23 species from 17 genera of macrofungi were obtained from three observation routes around the Sanggabuana Mountain area, Tegalwaru District, Karawang Sub-district, West Java.
2. The diversity index of each route falls into the low diversity category, namely in Route A (1.777), Route B (1.880), and Route C (2.206).
3. The highest encounter frequency of fungi on Route A is Trametes sp (19%). The highest encounter frequency of fungi on Route B is Ganoderma applanatum (23%). Meanwhile, the highest encounter frequency on Route C is shared by three species: Microporus xanthopus, Xylaria sp., and Inonotus sp (10%).
4. The dominance index in Route A (Cigentis) falls into the high dominance category, which is 1.8, while the dominance index in Routes B (community plantation) and C (Kejayaan) falls into the low dominance category, which is 0.17 and 0.16 respectively.

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