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INVENTORY OF MACROFUNGI DIVERSITY ON THE CANOPY TRACK AND CIPADARANTEN 1 TRACK IN THE PPKA BODOGOL AREA, SUKABUMI, WEST JAVA

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ABSTRACT

The inventory of macrofungi diversity on two routes, namely the Kanopi route and the Cipadaranten 1 route at the Bodogol Nature Conservation and Education Center (PPKA), aims to determine the diversity of macrofungi species that live in the area. The research method used is direct observation in the Canopy and Cipadaranten 1 route areas. With the condition of the trees on both routes which are still quite dense and the soil area is still damp due to the cover of the trees, there is great potential for the growth of various types of macrofungi. The results obtained during research on both routes and identification produced 24 species of macrofungi Microporus sp. 1, Microporus sp. 2, Microporus sp. 3, Trametes sp.1, Lenzites sp, Ganoderma sp., Ganoderma boninense, Trametes sp.2, Microporus xanthopus, Hexagonia sp, Trametes parvispora, Microporus sp. 4, Hygrocybe aurantiosplendens, Hygrocybe sp., Marasmius sp. 1, Collybia aurea, Crepidotus sp., Volvariella sp., Marasmius sp. 2, Lycoperdon sp., Marasmiellus sp. Coprinus sp. Stereum sp., Auricularia sp. The results obtained prove that the diversity of macrofungi types on the Kanopi and Cipadaranten 1 routes in PPKA Bodogol, West Java is very diverse and varied.

Keywords: *inventory, macrofungi, cipadaranten, bodogol*

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INTRODUCTION

The Bodogol Nature Conservation Education Center (PPKAB) is a conservation center with natural forest areas located at the north-western foot of Mount Pangrango in Mount Gede Pangrango National Park (Sadili et al. 2007). PPKAB was officially approved by the Minister of Forestry in 1998, in order to provide an understanding of nature in West Java or Indonesia, especially the tropical flora and fauna that live to support these forest areas. The Bodogol forest area plays a very important role in the field of research and conservation. In the Bodogol PPKA area in Sukabumi, you can find fungi, both microscopic and macroscopic fungi. There are several types of fungi that can be used for food, medicinal properties, and there are also fungi that can cause poisoning (Bahrun and Muchroji, 2005). According to Wahyudi, et al. (2016), fungi are heterotrophic organisms that live in the environment around humans or other living things and are often found during rainy periods because mushrooms need a fairly wet place to support their growth. The diversity of fungi in the world reaches 1,500,000 types with 200,000 species from Indonesia. 200,000 are macrofungi and microfungi species, but in terms of their number distribution and

ecological aspects, there is still no clear information about the diversity of macrofungi in Indonesia (Gandjar et al., 2006)

According to Tjitrosoepomo (2005), the main characteristics in distinguishing macrofungi morphology are based on the size and color of the fruit body. However, when the mushroom body is oxidized with oxygen from the outside air, it will cause a change in the color of the mushroom fruiting body. Several types of mushrooms have a brittle texture which makes it easier for the mushroom body to be damaged if it is injured from external shocks (Chang and Miles, 2004). The body of the fungus consists of hyphae or fine threads called mycelium. The mycelium may or may not have partitions. The process of reproduction with spores in fungi that live in dry habitats or on land is to produce spores which are produced in the ascus, whereas in fungi that live in water it produces twin spores. Fungi reproduce by endospores and exospores if they occur outside the basidium. Sexual reproduction of fungi can take place in various ways, namely, isogamy, oogami, gametaniogami if gametangia of different sexes mate, somagami if two undifferentiated thallus cells mate, and anisogamy (Zul, 2019).

According to Meitini (2012), macrofungi are often found growing in forest areas where large amounts of humus are found. Piles of garbage, dead trees that are weathered are places where fungi belonging to Basidiomycetes and Ascomycetes can thrive because these places contain rich carbohydrates, cellulose, and also lignin (Aryani, 2013). The growth of mushroom spores is also influenced by air humidity and moisture content, this is evidenced that the growth of mushrooms that produce better mushroom fruit occurs during the rainy season (Pacioni, 1981). With the great potential of the forest area in PPKA Bodogol for the diversity of macrofungi species that live in it, this study aims to determine the diversity of macrofungi in the PPKA Bodogol area as well as data reference for further macrofungi research.

METHOD

This research is a field research conducted for 3 days from 19 June to 21 June 2021. This field research used 2 routes which were carried out in the Bodogol PPKA Area, Sukabumi, West Java, namely; Canopy lane and Cipadaranten route 1. The tools used during field research are; field research location map, data tabulation, stationery, mobile phone, pH meter, hygrometer, altimeter, thermometer, GPS, camera, meter, 5 x 5m rope, identification key book. Data collection was carried out by direct observation on the Canopy line and Cipadaranten 1 line where there were macrofungi in the area where there were macrofungi from the Basidiomycota and Ascomycota phyla. The data collection process uses the plot method with a plot size of 5 x 5 m with 10 plots in each lane. Observations were made around the Canopy and Cipadaranten 1 lanes. Calculations and observations of macrofungi were carried out on the fungi that entered each plot. The macrofungi were then photographed and the morphological characteristics or descriptions recorded, the growing substrate, and the location found for species identification purposes. The observed macrofungi inhabited the soil, dead or alive tree trunks and litter on the Canopy route and Cipadaranten 1 route. In addition, measurements of altitude, temperature, humidity, pH and light intensity were also carried out on the observed paths. The measurement of environmental factors was carried out three times in each path, namely, in the 1st plot, the 5th plot and the 10th plot. The data analysis technique was then continued by determining the types of all macrofungi found in the Canopy line and Cipadaranten 1 line in the PPKA Bodogol area. The macrofungi obtained were then analyzed using the dominance index, evenness index and species diversity index using the following formula:

Species diversity (H') is analyzed using the Shannon-Wiener Diversity Index, with the following equation:

$$\boldsymbol{C = \sum Pi^2} \quad ; \quad \boldsymbol{Pi = \left(\frac{ni}{N}\right)}$$

Information:
H'= diversity index
ni = Number of individuals of the i-th species
N = Total number of individuals in the sample
s = Total number of individuals of all species
Ni = number of individuals of type i
N = total number of individuals of all species
The range of diversity index (H') values based on this formula is:
a. H' < 1 = Low diversity
b. 1 ≤ H' ≤ 3 = Moderate diversity

c. H' > 3 = high diversity
The evenness index (e) is analyzed using the Pielou Index, with the following formula:

$$e = \frac{H'}{H\,max} \;;\; H\,\max = LnS$$

Information:
e = Pielou's evenness index (evennesaindex)
H' = Diversity index
S = Number of species
Hmax = Maximum species diversity = Ln S
According to Pielou, the criteria based on the evenness index are as follows:
a. 0.00 – 0.25 = Not evenly distributed
b. 0.26 – 0.50 = Less than equal
c. 0.51 – 0.75 = Fairly even
d. 0.76 – 0.95 = Almost even
e. 0.96 – 1.00 = Evenly
Dominance index (C) is analyzed using Simpson's Dominance Index, with the following equation:

$$H' = -\sum_{i=s}^{s} pi \ln pi \;;\; pi = \frac{ni}{N}$$

Information:
C = Simpson's dominance index
ni = total number of individuals of type i
N = the number of all individuals in total n
Pi = ni/N = as the proportion of the ith type
The range of dominance index (C) values based on this formula, according to Simpson, is:
a. $0 < C \leq 0.5$ = Low Dominance
b. $0.5 < C \leq 0.75$ = Moderate Dominance
c. $0.75 < C \leq 1.00$ = High Dominance

DISCUSSION RESULT

The types of macroscopic fungi found in two lines, namely the Cipadaranten 1 line and the Canopy line as a whole are 15 genera with different values for each line. On the Cipadaranten 1 route, 12 genera were found and 6 genera were found on the Kanopi route. The number of individual macroscopic fungi obtained in each route has different values. The difference in the number of individuals obtained was influenced by the total area of the sample area taken and the environmental conditions in the two pathways. Environmental factors that can influence the growth of macrofungi include soil pH, humidity, light intensity and altitude.

Table 1. Data on the number of individuals on the canopy route

No.	Types of Mushrooms	Number of individuals (ni)
1	*Lycoperdon* sp.	57
2	*Auricularia* sp.	3
3	*Coprynus* sp.	9
4	*Mycroporus* sp.	7
5	*Marasmius* sp.	74
6	*Marasmiellus* sp.	10

Total (N)	160

Table 2. Data on the number of individuals on the Cipadaranten 1 route

Name	Number
Microporus sp. 1	87
Microporus sp. 2	45
Microporus sp. 3	120
Trametes sp.1	35
Lenzites sp	57
Marasmius sp.	79
Collybia aurea	5
Ganoderma sp.	72
Ganoderma boninense	23
Hygrocybe aurantiosplendens	8
Hygrocybe sp.	2
Trametes sp.2	24
Microporus xanthopus	143
Hexagonia sp	23
Trametes parvispora	35
Crepidotus sp.	21
Volvariella sp.	14
Stereum sp.	15
Lycoperdon sp.	9
Auricularia sp.	23
Coprinus sp.	13
Total	**853**

The number of individuals will also be influenced by environmental factors that can support the growth of macroscopic fungi. Macroscopic fungi grow individually or in colonies. Environmental factors such as soil pH, humidity, temperature, light intensity and altitude are factors supporting the growth of macroscopic fungi. The environmental factors found in each route vary greatly.

Table 3. Data on environmental conditions on the Cipadaranten 1 route and the Canopy route

Track	Environmental factor				
	humidity	Temperature	Light intensity	Soil Ph	Altitude
Cipadaranten 1	41,7%	26,9°C	934 lux	6,26	863 mdpl
Kanopi	46,2%	24,46°C	200 lux	5,93	867,8 mdpl

On the Cipadaranten 1 route, the environmental factor has an average humidity of 41.7%, an average temperature of 26.9°C, an average light intensity of 934 lux, an average soil pH of 6.26, and an altitude of 863 masl. All the mushrooms found on the Cipadaranten 1 route were in forest litter, on dead trees, on living plants, and found on the ground. The dominant fungal genera in this fungus are Ganoderma and Microporus. Thomas and Gary (2002) said that temperature and relative humidity in ecosystems affect the development of fungal hyphae. Physical factors that greatly affect the life of the fungus include temperature, humidity, altitude, and substrate pH. Retrieval of mushroom data on the Cipadaranten 1 route during the day is slightly overcast so that the detected temperature is quite high and the humidity is low. Based on the substrate, the fungi in the Cipadaranten 1 pathway were found mostly on dead tree trunks.

Mushrooms found on dead tree trunks cause the intensity of light and humidity at the location where the fungus is found to support the growth of the fungus.

The canopy route has an average humidity factor of 46.2%, average temperature of 24.46°C, average light intensity of 200 lux, average soil pH of 5.93, and altitude of 867.8 masl. The dominant fungal genera in this pathway are Marasmius and Microporus. In the Marasmius genus, the morphology has a smooth texture, white cream in color, decurved margins, dry surface. Gills are adnexed to adnate. Cylindrical stipe, 2-2.5 cm in diameter, found in dead logs. The canopy route has the highest humidity, this is one of the supporting factors for the high diversity of the genus Microporus. The more humid the conditions of an environment, the more abundant the growth of macrofungi in that place. Conversely, if the light intensity is high, the growth of fungi in that place will be lower. This is because in general macrofungi will grow in humid environmental conditions, especially during the rainy season. In addition, macrofungi are also more often found growing on weathered wood and litter and trees that have high humidity (Hiola, 2011). According to Praborini (2012), during the rainy season, air humidity and substrate humidity are higher than in the dry season. Microporus is a genus that commonly grows in the TNGGP area and is often found along the route to Cipadaranten 1 Waterfall. These results confirm the data provided by Rezky et al (2012) who reported that the mushrooms in TNGGP were dominated by Microporus and Polyporus.

Nature Conservation Research Center, Bodogol is a tropical rain forest at the foot of Mount Gede Pangrango with an altitude of about 800 meters above sea level. This area has large trees with tightly closed canopies and some fallen and dead trees. The soil surface in this area is generally covered with leaf litter and weathered branches. These environmental conditions are very suitable in supporting the growth and development of macroscopic fungi because of the availability of optimal substrates for growth and suitable environmental conditions (Dendang 2008).

Table 4. Diversity index, evenness index and dominance index on the Canopy route and Cipadaranten route 1

Location	Diversity Index	Evenness Index	Dominance Index
Canopy route	1.27	0.57	35 %
Cipadaranten route 1	2.66	1.15	69.30%

The highest diversity index was found on the Cipadaranten 1 route, namely 2.66%, while on the Kanopi route it was 1.27%. The high diversity index on the Cipadaranten 1 route is caused by supportive environmental conditions (Table 3) and the growing substrate is more varied than on the Canopy route. The Cipadaranten 1 route is composed of tree vegetation, dead wood branches and twigs, and lots of litter is found on the surface of the ground. These conditions make it very possible for various types of fungi to grow. Based on the Shannon-Winner test, the species diversity index on each route is included in the medium category. Odum (1996) states that diversity includes two important things, namely the number of types in a community and the abundance of each type, so that the smaller the number of types and the variation in the number of individuals of each type or there are several individuals whose numbers are much greater, the the diversity of an ecosystem will decrease.

The evenness index and dominance index can be seen in table 4 which shows that the evenness index and dominance index are greater on the Cipadaranten 1 route than on the Kanopi route. The dominance index on these two lines is in the high dominance category. The evenness index on the Kanopi route is in the fairly even category, while the Cipadaranten 1 route is in the even category. The high dominance index of macroscopic fungal species, especially dead wood stems and twigs and litter. Environmental conditions, both abiotic and biotic factors, also greatly influence the production of fungi in each pathway. Evergreen has a high species diversity index while monsoon forests have a low diversity index. This proves that vegetation conditions and environmental factors influence fungal growth. There is quite a lot of substrate available in evergreens, so that various fungi can grow well. While the monsoon forest has fairly dense shade, it is dominated by shrubs, thereby reducing the variation in substrate which is an important element for fungal growth. This is in accordance with research conducted by Wahyudi, Linda, and Khotimah (2012), that environmental factors influence the growth of macroscopic fungi. Uneven distribution of fungi can be caused by differences in path types and environmental factors. The same type of fungus will only be found on paths that have similar paths. Humid forest conditions cause the need for water and other nutrients for mushroom growth to be met properly. The large number of fallen trees

provides a suitable substrate for fungal growth, besides that these fungi grow in very large numbers, causing high frequency values.

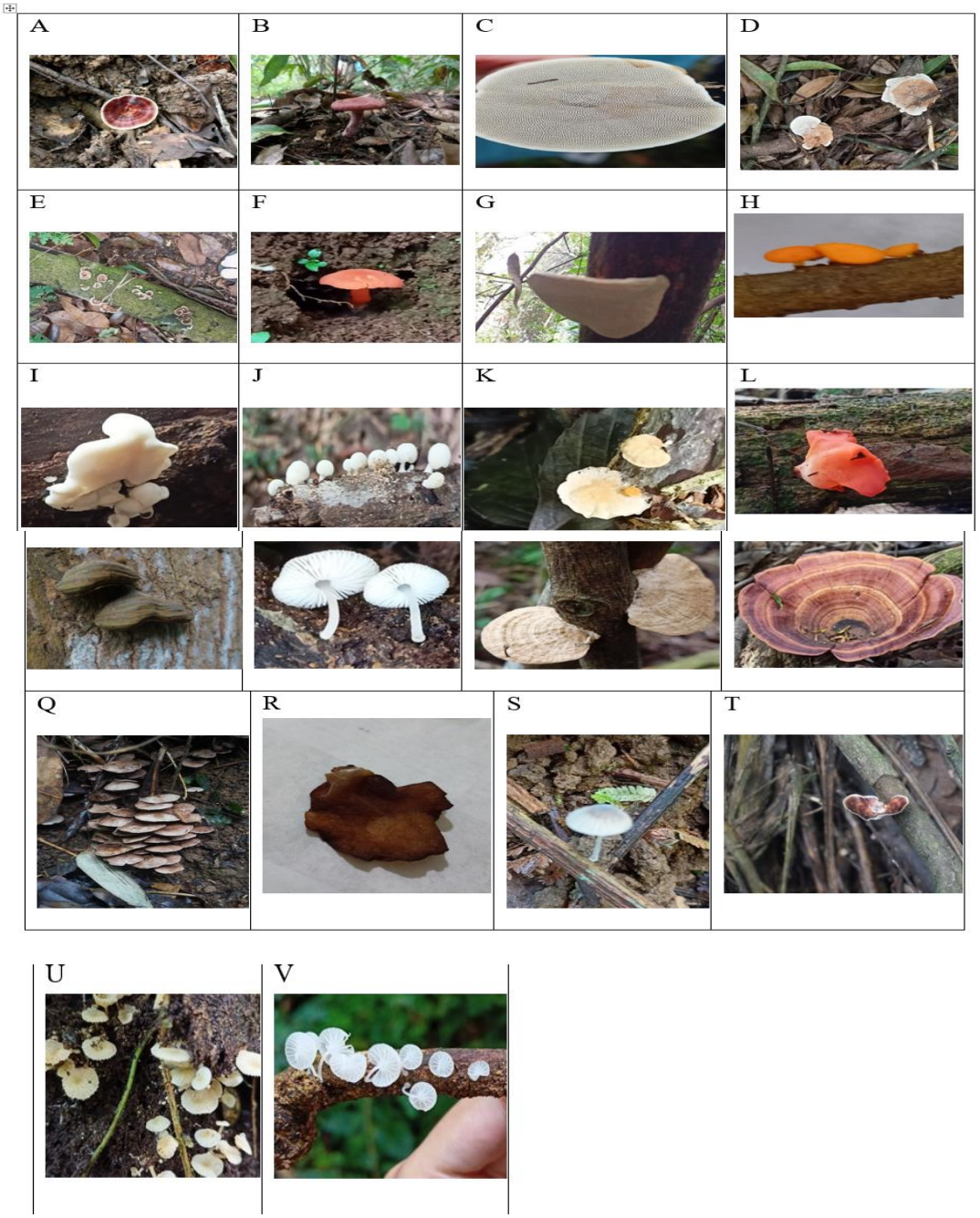

Figure 1. Some macroscopic fungi found in the Cipadaranten 1 and Canopy lanes.

(A) Microporus xanthopus, (B) Russula rosea, (C) Hexagonia sp, (D) Trametes parvispora, (E) Lenzites sp, (F) Collybia aurea, (G) Ganoderma boninense, (H) Hygrocybe aurantiosplendens, (I) Crepidotus sp, (J) Volvariella sp, (K) Stereum sp, (L) Hygrocybe sp, (M) Ganoderma sp, (N) Marasmius sp, (O) Trametes sp, (P) Microporus sp. (Q) Lycoperdon sp, (R) Auricularia sp, (S) Coprinus sp, (T) Microporus sp, (U) Marasmius sp, (V) Marasmiellus sp.

The number of fungal species on the Cipadaranten 1 route is 21 species. Of the 21 species, Trametes sp is dark brown. Trametes sp. It has serrated edges with a grooved umbrella surface and a texture resembling hard leather. Trametes sp. does not have a fruit stalk so the hood is directly attached to the wood. On the body of Trametes sp. You can see the zonation of fungal growth, and the shape of the basidiocarp of the fruit body is like a wriggling turkey tail.

CONCLUSION

Research conducted in the Canopy and Cipadaranten 1 routes. The results found 24 species of macrofungi that had been identified. Of the 24 species that were obtained the most were obtained from 2 orders, namely Polyporales and Agaricales. The most species. The dominant macrofungi found in both pathways were species from the genus Microporus. The most common individual mushrooms found were Microporus sp. 3 and Microporus xanthopus, both of these fungi were found attached to the wood substrate of living dead trees. In this study it was found that the evenness index and dominance index for the Cipadaranten 1 route were greater than the Canopy route. The dominance index on these two lines is in the high dominance category. The evenness index on the Kanopi route is in the fairly even category, while the Cipadaranten 1 route is in the even category. The high dominance index of macroscopic fungal species, especially dead wood stems and twigs and litter.

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