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ECTOMYCORRHIZAL MUSHROOMS DIVERSITY IN SORAYA RESEARCH STATION LEUSER ECOSYSTEM

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ABSTRAK

Jamur makro ektomikoriza bersimbiosis mutualistik dengan beberapa tanaman antara lain dari famili Dipterocarpaceae, Myrtaceae, dan Fagaceae. Keberadaan jamur makro ektomikoriza di alam sangat penting untuk dilestarikan, oleh karena itu penelitian ini dilakukan untuk mengetahui keanekaragaman jamur makro ektomikoriza di Stasiun Penelitian Soraya. Penelitian ini bertujuan untuk mengetahui keragaman jamur makro ektomikoriza di Stasiun Penelitian Soraya Subulussalam, Kawasan Ekosistem Leuser. Penelitian dilakukan pada bulan Agustus 2021 sampai dengan bulan Januari 2022. Metode penelitian yang digunakan adalah survey eksploratif, pengambilan sampel menggunakan metode kuadrat, dengan menggunakan plot permanen fenologi sebanyak 20 plot berukuran 20 m x 20 m, yang diletakkan secara acak di hutan sekunder Stasiun Penelitian Soraya. Hasil yang didapatkan terdiri dari 5 ordo, 14 famili, 31 spesies, dan 1440 jumlah individu jamur makro ektomikoriza. Jumlah spesies yang paling banyak didapatkan dari famili Boletaceae, yaitu 5 spesies, dan famili Russulaceae berjumlah 4 spesies. Indeks keragaman spesies jamur makro ektomikoriza tergolong sedang yaitu 2,997.

Kata kunci: Ekosistem Leuser, Jamur ektomikoriza, Keragaman, Stasiun Penelitian Soraya

ABSTRACT

Ectomycorrhizal macro fungi have a mutualistic symbiosis with several plants, including those from the Dipterocarpaceae, Myrtaceae, and Fagaceae families. The existence of ectomycorrhizal macro fungi in nature is very important to preserve, therefore this study was conducted to determine the diversity of ectomycorrhizal macro fungi at Soraya Research Station. This study aims to

determine the diversity of ectomycorrhizal macro fungi at the Soraya Research Stasiun Subulussalam, Leuser Ecosystem Area. The study was conducted from August 2021 to January 2022. The research method used is an exploratory survey, sampling using the squared method, using a permanent phenological plot of 20 plots measuring 20 m x 20 m, which are randomly placed in the secondary forest of the Soraya Research Station. The results obtained consisted of 5 orders, 14 families, 31 species, and 1440 individual numbers of ectomycorrhizal macro fungi. The most numerous species are obtained from the Boletaceae family, which is 5 species, and the Russulaceae family is 4 species. The ectomycorrhizal macro fungi species diversity index is relatively moderate at 2,997.

Keywords: Diversity, Ectomycorrhizal mushrooms, Leuser Ecosystem, Soraya Research Station

INTRODUCTION

Fungi are components that have an important role in forest ecosystems, which function as decomposers [1], in the nutrient cycle [2], and also symbiotic with other organisms, one of which is the symbiosis between fungi and plant roots called mycorrhiza [3]. In daily life, fungi can be used as food, medicine, and also as fertilizer in agriculture [4].

Fungi are the second largest community after insects, fungi have complex forms ranging from unicellular, filaments until some of them have a sporocarp (fruiting body). The number of fungi globally ranges from 2.2-3.8 million species. As much as 10% of these are macrofungi, which are estimated to number 220,000-380,000 species [5]. The growth of macro fungi in their habitat is strongly influenced by suitable environmental conditions [6].

Some of the physical and chemical environmental factors that affect mold growth are, light intensity, air and soil temperature, air and soil moisture, and appropriate soil pH [7]. In addition, habitat also affects the growth of macro fungi, namely lowland rainforests are the main habitat for macro fungi [6]. One of the lowland tropical rainforests is found in the Leuser Ecosystem. The 2.6 million hectare Leuser Ecosystem consists of several research stations, including

Ketambe, Suaq Balimbing and Soraya Research Stations.

Soraya Research Station is an area that has various types of flora, fauna, and includes macro fungi that need to be maintained and preserved in nature [8]. The climatic conditions at Soraya Research Station are very supportive for the growth of macro fungi. Several macro fungal studies that have been conducted at Soraya Research Station, namely, an inventory of wood fungi which obtained 127 species dominated by the Polyporaceae Family [9]. In addition, research conducted by [10] found 158 species dominated by the Order Agaricales. As for vegetation, it is known that Soraya Research Station is dominated by plants from the Euphorbiaceae and Dipterocarpaceae families [11].

Ectomycorrhizal macro fungi have a mutualistic symbiosis with several plants, including those from the Dipterocarpaceae, Myrtaceae, and Fagaceae families [12, 7, 13]. The role of ectomycorrhizal fungi for plants is to help the absorption of nutrients and nutrients [12,14,15], increase plant resistance to pathogen attack [16, 17], increase drought resistance [18,19], increase phosphorus and nitrogen nutrient uptake [20], and increase plant tolerance to heavy metal toxicity [21].

The existence of ectomycorrhizal macro fungi in nature is very important to preserve, therefore this study was conducted to determine the diversity of ectomycorrhizal macro fungi at Soraya Research Station. Various ectomycorrhizal host plants, such as Dipterocarpaceae, Myrtaceae, Fabaceae and others can be found at Soraya Research Station. In addition, the Soraya Research Station area has experienced succession to grow into a secondary forest. Based on this, it is necessary to conduct research on the diversity of ectomycorrhizal macro fungi at Soraya Research Station.

RESEARCH METHOD

The research was conducted at Soraya Research Station, Sultan Daulat Subulussalam. The observation plot used phenological plots at Soraya Research Station (picture 1). Data collection was conducted from September to October 2021. Preservation and identification of samples were carried out in the Ecology and Herbarium Acehense laboratory,

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Picture 1. Phenology Plot Map of Soraya Research Station (Leuser Conservation Forum)

This study used an exploratory survey method, sampling using the quadrat method, using phenological permanent plots placed randomly in the secondary forest of Soraya Research Station.

Tools

The equipment used in this research are GPS (Global Positioning System), digital camera, sample bottle, knife, macro lens, field notes, stationery, soil thermometer, soil tester, thermohygrometer, lux meter.

Materials

The materials used in this study were name tags, 70% alcohol, ectomycorrhizal macro fungi.

Work Procedure

Sample Collection and Identification of Ectomycorrhizal Macro-fungi

All fruiting bodies of ectomycorrhizal macro fungi were collected in 20 m x 20 m observation plots, totaling 20 plots. The fruiting bodies found were first photographed in their natural habitat. Fungal characters

were observed and recorded, such as the shape of the hood, color, texture, ring, and also volva, then the fruiting body was taken and then put into a sample bottle [22]. Specimen identification continued in the laboratory using references published by [23, 24, 12, 25], and other reference sources such as scientific journals.

The results of the analysis are presented in tables and figures. The research data were analyzed descriptively including morphological characters (fruiting body color, stipe shape, hood shape, lamella, annulus, and also volva) and quantitative analysis. Analysis of species diversity using the Shannon-Wiener diversity index.

Species diversity of ectomycorrhizal fungi can be calculated using the Shannon-Wiener diversity index (Ludwig and Renold 1988):

$H' = -\sum P_i \ln P_i$ .....(1)

$Pi = = \frac{n_i}{N}$ .....(2)

Description:

H': Shannon-Wiener diversity index; ni: number of individuals of each species; and N: total number of individuals of ectomycorrhizal fungi.

Diversity index criteria: H'≤ 1: low diversity; 1 ≤ H' ≥ 3: medium diversity; and H'>3: high diversity

RESULT AND DISCUSSION

The results of the identification of ectomycorrhizal macro fungi obtained at Soraya Research Station in the Leuser Ecosystem Area obtained a total of 1440 individuals and 31 species, which are classified into 14 families, 5 orders, and 1 phylum namely Basidiomycota (Table 1).

Table 1. Ectomycorrhizal Macro-fungal Species at Soraya Research Station

No	Ordo	Family	Species	Number of Individuals
1.	Agaricales	Hygrophoraceae	*Hygrocybe cantharellus*	50
2.		Hydnangiaceae	*Laccaria bicolor*	18
3.			*Laccaria amethystina*	41
4.		Amanitaceae	*Amanita regalis*	10
5.			*Amanita hemibapha*	16
6.			*Amanita virginea*	16
7.		Agaricaceae	*Calvatia craniiformis*	12
8.			*Calvatia rugosa*	6
9.		Inocybaceae	*Inocybe geophylla*	5
10.			*Inocybe rimosa*	170

No	Ordo	Family	Species	Number of Individuals
11.		Lycoperdaceae	*Lycoperdon perlatum*	24
12.		Entolomataceae	*Entoloma chytropilum*	183
13.		Tricholomataceae	*Clytocybe* sp.	20
14.	Boletales	Boletaceae	*Suillus bovinus*	59
15.			*Heimioporus* sp.	11
16.			*Boletus* sp.	27
17.			*Boletus* sp.2	23
18.			*Phylloporus bellus*	22
19.		Sclerodermataceae	*Calostoma ravenelii*	61
20.			*Calostoma microsporum*	60
21.			*Scleroderma citrinum*	61
22.		Rhizopogonaceae	*Rhizopogon* sp.	52
23.			*Rhizopogon granuloflavus*	48
24.	Cantharellales	Cantharellaceae	*Cantharellus ianthinus*	227
25.	Gomphales	Gomphaceae	*Ramaria zippelii*	20
26.			*Ramaria formosa*	27
27.			*Ramaria stricta*	37
28.	Russulales	Russulaceae	*Lactarius sumstinei*	58
29.			*Russula cyanoxantha*	20
30.			*Russula albida*	38
31.			*Russula rosea*	18
Total				**1440**

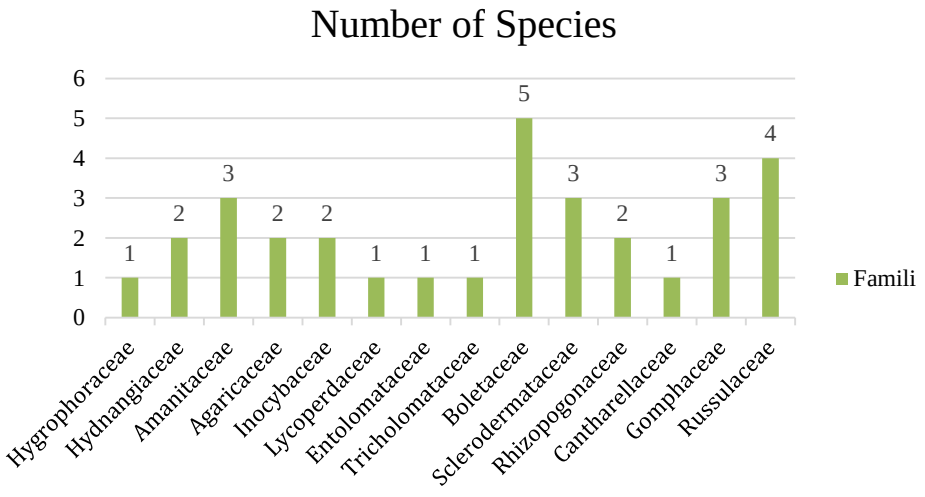
Table 1. shows that all species obtained belong to the Basidiomycota phylum. This is because ectomycorrhizal fungi are dominated by the phylum Basiodiomycota, as has been found by [12, 7,]. The Boletaceae family has the highest number of species, namely 5 species, followed by Russulaceae which consists of 4 species. This is the same as the results of research by [26], which found 14 families of Basidiomycota, mostly from Russulaceae, Boletaceae, and Amanitaceae.

The number of ectomycorrhizal macro fungal species obtained is smaller when compared to the results of research obtained by [27] secondary tropical forests on the island of Bangka with the results of 56 species of ectomycorrhizal fungi dominated by the Thelephoraceae, Russulaceae, and Clavulinaceae families. The results of this study have a similar number of species with those obtained in the Dipterocarp forest ecosystem in the Labanan Special Purpose Forest Area (KHDTK) totaling 31 species, which are dominated by the Russulaceae

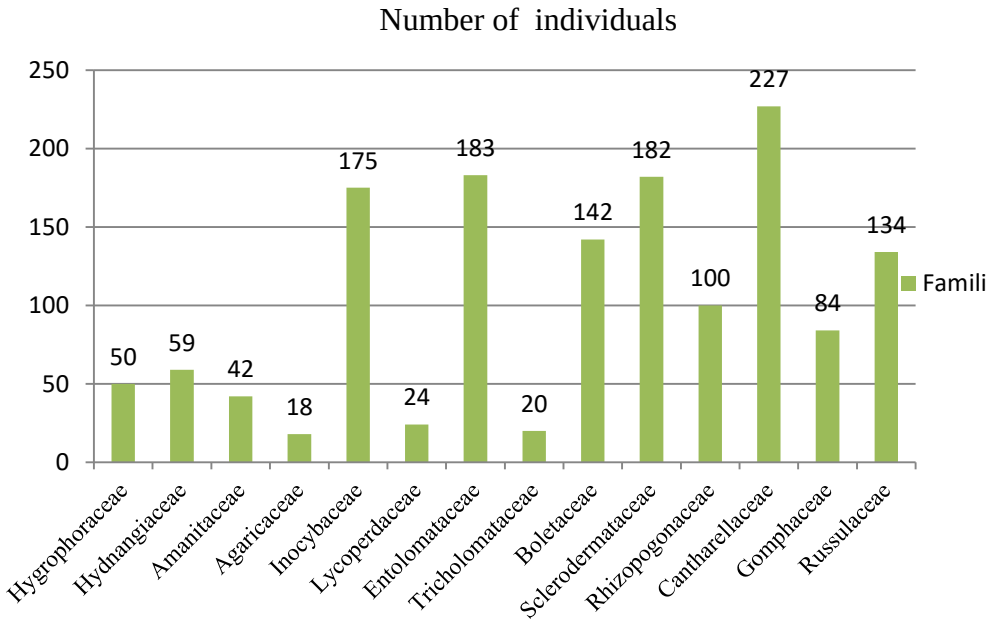
family [7]. However, the number of results of this study is greater when compared to the results of research in South Kalimantan which amounted to 7 species and belonged to 4 genus [28]. and ectomycorrhizal fungi in Sipirok, Tongkoh, and Aek Nauli Forest Areas, Sumatra Utara, totaling 16 species, dominated by the Russulaceae family.

The number of species can be seen in Picture 2, species from the Boletaceae family are the most commonly found, namely 5 species. This is because species from the Boletaceae family generally act as mycorrhizae and have a variety of host species. The results of research from [26], the Boletaceae family is also one of the dominant species found in Malaysian tropical forests.

The Russulaceae family is the second largest with 4 species, the Russulasceae family is the dominant ectomycorrhizal species in tropical forests. Based on research by [7] from 31 species of ectomycorrhizal fungi found in the Dipterocarp forest of KHDK Labanan, the Russulaceae family is the most dominant species. This was because all members of the Russulaceae family are ectomycorrhizas that are symbiotic with plants from the Dipterocarpaceae and non-Dipterocarpaceae families.Based on research conducted in Malaysia by [26], of the 14 families in the Basidiomycota, dominated by the Russulaceae, Amanitaceae and Boletaceae families.



Picture 2. Histogram of the Number of Ectomycorrhizal Macro-fungal Species at Soraya Research Station



Picture 3. Histogram of the number of individual ectomycorrhizal macro fungi at Soraya Research Station

The number of individuals of ectomycorrhizal fungi found at Soraya Research Station can be seen in Picture 3. The highest number of individuals is members of the Cantharellaceae family, namely 227 individuals. This is because species of the Cantharellaceae family live in colonies and each colony produces a large number of basidiomes or fruiting bodies, one colony consisting of 10-20 individuals. In addition, it is also because the Cantharellaceae family has a wide distribution and also has a variety of host species [28].

The least number of fungi individuals is a member of the Agaricaceae family, which is 18 individuals. This is because the growth of these fungi is sometimes solitary, although some grow in colonies, but the number of fruiting bodies only amounts to 2-5 individuals. In contrast to members of the Sclerodermatataceae family, although sometimes growing solitarily, the Sclerodermataceae family, especially the species *Scleroderma citrinum*, is widely distributed, and has a very diverse host species [26].

Diversity of ectomycorrhizal macro-fungi at Soraya Research Station

Species diversity of ectomycorrhizal macro fungi at Soraya

Research Station based on the value of the Shannon Wiener species diversity index (H'). The results of the analysis showed that the diversity index value at the research site was 2.997, indicating that the species diversity at the site was classified as moderate. The species diversity index describes the condition of the species that make up a forest. The limit of the maximum H value in a good forest as a whole is in the interval $2.5 \leq H \max \leq 3.5$. Similarly, according to the criteria of [14], the species diversity index greater than 3 indicates abundant species diversity, values between 1-3 moderate species diversity, and values smaller than 1 indicate little/less diversity. The highest diversity value is found in *Catharellus* sp.

The results of this study are preliminary data for the diversity of ectomycorrhizal macro fungi, this is due to the limited availability of morphological characters (mushroom fruiting bodies). The growth of the fruiting bodies of ectomycorrhizal macro fungi is strongly influenced by environmental factors, so the time and length of research will affect the results of ectomycorrhizal macro fungi. The Basidiomycota phylum is the most commonly found, because it is a phylum that generally includes ectomycorrhizal members associated with dipterocarp plants, such as those found in the lowland forests of Peninsular Malaysia, ectomycorrhizal fungi dominated by the Amanitaceae, Boletaceae, Catharellaceae, and Russulaceae families [12].

CONCLUSION

The species of ectomycorrhizal macrofungi found at Soraya Research Station were 31 species, consisting of the orders Agaricales, Boletales, Cantharellales, Gomphales, and Russulales.

The results of the analysis showed that the diversity index value at the research site was 2.997, indicating that the species diversity at the site was classified as moderate.

Ectomycorrhizal macro fungi at Soraya Research Station were dominated by species from the Boletaceae, and Russulaceae families. the number of individuals was dominated by species from the Cantharellaceae, Entolomataceae, and Sclerodermataceae families.

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