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MORPHOLOGICAL IDENTIFICATION OF WILD EDIBLE MUSHROOM (*Termitomyces striatus*) AT IPB UNIVERSITY CAMPUS FOREST

[1]Nurhakiki and [2*]Ivan Permana Putra

[1]Microbiology Study Program, Department of Biology, Graduate School Bogor Agricultural Institute, Bogor, Indonesia
[2*]Department of Biology, Faculty of Mathematics and Natural Sciences, Bogor Agricultural Institute, Bogor, Indonesia

*Email: ivanpermanaputra@apps.ipb.ac.id

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ABSTRAK

Indonesia merupakan negara tropis yang terkenal dengan adanya dua musim yaitu musim penghujan dan musim kemarau. Pada saat memasuki musim hujan, tingkat kelembapan akan meningkat sehingga berperan dalam inisiasi munculnya tubuh buah jamur, termasuk jamur *edible*. Penelitian mengenai keanekaragaman jamur *edible* liar perlu dilakukan secara lebih masif di berbagai daerah di Indonesia. Salah satunya dengan melakukan observasi jamur liar *edible* di kawasan Hutan Kampus IPB University (HKIU). Penelitian ini bertujuan mengeksplorasi dan mengidentifikasi jamur edible yang ada di HKIU. Eksplorasi dilakukan dengan metode sampling opportunistik. Jamur yang ditemukan kemudian diidentifikasi karakter morfologi makroskopis dan mikroskopisnya. Hasil identifikasi berdasarkan karakter morfologi tubuh buah mengkonfirmasi bahwa jamur yang diperoleh dari kawasan HKIU merupakan jamur *Termitomyces striatus* yang *edible.* Temuan ini dapat memberikan tambahan informasi mengenai persebaran *T. striatus* di Indonesia serta potensi yang dimilikinya sehingga menjadi dasar untuk melestarikan dan pengembangan budidaya jamur di masa mendatang.

Kata Kunci: Eksplorasi, Hutan Kampus, Jamur, *Termitomyces.*

ABSTRACT

Indonesia is a tropical country which is famous for its 2 seasons, namely the rainy season and the dry season. In the rainy season, the humidity level will increase and induce the development of mushroom's fruiting body, including the edible species. The research on wild edible mushroom diversity should be carried out massively in various regions in Indonesia. One of the potential areas is the forest area of the IPB University Campus (HKIU). This study aims to explore and identify wild edible mushroom in HKIU. The mushroom exploration was done

using an opportunistic sampling method. Selected wild mushroom was obtained and identified for macroscopic and microscopic morphological characters. The identification results based on the morphological characters of the fruiting bodies indicated that the mushrooms obtained from the current study is *Termitomyces striatus* which is acknowledged as an edible mushroom. Our finding can provide the additional information on distribution of *T. striatus* in Indonesia and the potential of this mushroom cultivation in foreseeable future.

Keywords: Campus Forest, Exploration, Mushroom, *Termitomyces*.

INTRODUCTION

Indonesia is known as a tropical country with the largest area of tropical rainforest after Brazil and Congo and has two seasons, namely the rainy and dry seasons. In the rainy season, humidity levels will increase to induce the development of fungal fruiting bodies [1];[2]. Fungi are the second largest group of organisms, estimated to consist of 11.7–13.2 million species; however, to date, only 150,000 fungal species have been explored in their entirety [3]. Fungi are distributed worldwide and have an essential role in various roles as mycorrhizae, saprotrophs, parasites, and entomopathogens in various ecosystems [3];[4]. Fungi are classified as eukaryotic organisms, heterotrophs, characterized by chitin cell walls, reproduce by spores, and can live in various habitats. Fungi have the ability to colonize various habitats with several living mechanisms, such as parasites, endophytes, and saprophytes.

Fungi are macroscopic fungi based on the size of the fruiting body. Fungi with large fruiting bodies (Mushrooms) are dominated by the Basidiomycota and Ascomycota Phylla. Macroscopic fungi generally have a fruiting body structure consisting of a cap, stalk, ring, and volva, but some without rings [1];[2]. In the identification process, fungi can be characterized based on morphological observations. Fungi usually live on rotting wood, soil surfaces, and litter. The parameters commonly used as references in observing fungi include macroscopic characteristics (shape, color, and texture of the fruit body) [5] and microscopic characteristics (spores, basidia, cystidia, and hyphae).

Previous research on macroscopic fungal diversity has been carried out in various regions in Indonesia, including the arboretum of the Faculty of Forestry, Lancang Kuning University, Pekanbaru, Riau [2], West Aceh [6] and Ambon Island [1]. However, most mushroom publications in Indonesia still need to be completed with documentation and descriptions of the reported mushrooms, making validation and dissemination of information difficult. In fact, there are still many places in Indonesia that have the potential to grow mushrooms, one of which is the campus forest of IPB University (HKIU), which is one of the state universities that has quite extensive campus forest areas in forest conditions with humidity levels that are very supportive for fungal growth. Therefore, it is necessary to explore in order to provide information about the types of mushrooms in the HKIU area and their potential so that it becomes the basis for preserving and developing mushroom cultivation. This research aims to explore and identify edible wild mushrooms in the HKIU area.

MATERIALS AND METHODS

Time and Sampling Site

The research was conducted in the HKIU area, West Java, from January to March 2023. The tools and materials used in this research were alcohol, distilled water, immersion oil, work stationery, pH meter, glass and object cover, microscope, tweezers, toothpicks, razor blade, and tissue.

Exploration

The specimens were collected using the exploration method by exploring the HKIU area [7]. The fruiting bodies were found in the HKIU Bamboo Arboretum area. The fungal samples obtained were then measured for their fruiting bodies and documented in situ, and information about the conditions of their growing environment was recorded.

Figure 1.Exploration site of wild edible mushroom (red circle),-6.562459,106.725971.

Preservation of Materials

Samples obtained from the field were preserved into a wet and dry method. Wet preservation was done by placing the mushroom sample in a glass bottle containing 70% alcohol solution until wholly submerged. Dry specimens were made by drying the mushroom fruit bodies using an oven for two days at 40 °C.

Morphological Identification

Morphological identification was carried out by observing macroscopic and microscopic fungal characters. Macroscopic observations

include several characteristics, including fruit body shape, fruit body size, fruit body color, the surface of the cap, edge of the cap, type of hymenophore, and substrate [8]. Microscopic observations were carried out using a Leica microscope with 1000x magnification, including spores, basidia, hyphae, and cystidia. Identification was carried out according to existing literature. Fungal samples were identified using an identification reference [9]

RESULTS AND DISCUSSIONS

Taxonomy

Termitomyces striatus (Beeli) R. Heim, Hong. Arg. (Buenos Aires) 18: 142 (1942)

Basyonim

Schulzeria striata Beeli 1938

Synonym

Termitomyces striatus var. annulatus R. Heim, Arch. Mus. Hist. Nat. Paris, ser. 6 18: 140 (1942)

Termitomyces striatus f. griseus R. Heim, Fl. Icon. champ. Congo 7: 144 (1958)

Termitomyces striatus f. subumbonatus Mossebo, in Mossebo, Amougou & Atangana, Bull. Soc. mycol. Fr. 118(3): 204 (2003)

Termitomyces striatus f. griseiumboides Mossebo [as 'grisumboides'], in Mossebo, Amougou & Atangana, Bull. Soc. mycol. Fr. 118(3): 214 (2003)

Termitomyces striatus f. bibasidiatus Mossebo, in Mossebo, Amougou & Atangana, Bull. Soc. mycol. Fr. 118(3): 207 (2003)

Termitomyces striatus f. pileatus Mossebo, in Mossebo, Njounkou, Piątek, Ayissi & Djasbe, Mycotaxon 107: 317 (2009)

Termitomyces striatus f. brunneus Mossebo, in Mossebo, Njounkou, Piątek, Ayissi & Djasbe, Mycotaxon 107: 320 (2009)

Termitomyces striatus f. camerunensis Mossebo, in Mossebo, Kengni Ayissi, Essouman, Tetang & Ambit, Bull. Soc. mycol. Fr. 127(1-2): 158 (2012).

The *Termitomyces* striatus has a stemmed fruit body and a cap with lamellae. The texture of the basidiomata was fleshy. The pileus was brownish cream colored with a darker color in the middle, with a pileus diameter of 4.6 cm. The surface of the pileus was slightly slippery when dry and slimy when wet. Pileus has a hood shape with shallow grooves (striated). The character of the margin was split, wavy, and curved downward (Figure 2A-C). The hymenophore type was lamellae, white to cream in color; the lamellae have a free attachment type and gills tightly arranged and

attached to the stipe (Figure 2D). The stipe was cylindrical and fleshy; the surface was white, finely striated or longitudinal, fibrous, and attached to the middle of the cap with the stipe 9 cm long and has no rings (Figure 2E). Observation showed that basidiospores were oval to ellipsoid in shape, with sizes ranging from 4 - 10 µm, yellowish green, smooth and thin-walled, inamyloid (Figure 3A). The basidia were clavate, and the hyphae are radial with a size of 52.60 µm (Figure 3B) interspersed with basidioles (Figure 3C). Two types of cystidia were found in this study (Figure 3 D, E). The hyphae on the trama are arranged in parallel (Figure 3F). Saprotrophic, found around leaf litter in humid temperature conditions in the Bamboo Arboretum area of the IPB University Campus, West Java (-6.562459,106.725971, March 2023, Nurhakiki, Herbarium (2F), deposited to the Mycology Division Laboratory, Department of Biology, IPB.

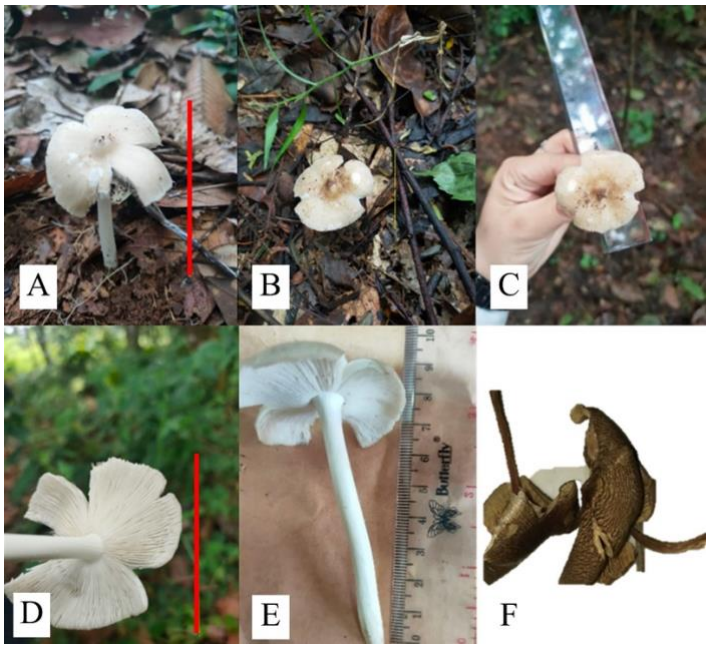

Figure 2. Macromorphological characters of Termitomyces striatus. (A) Basidiomata habit; (B,C) Pilus from upper view; (D) Pileus from underview, lamela; (E) Stipe; (F) Hebarium. Bars A and D = 10 cm.

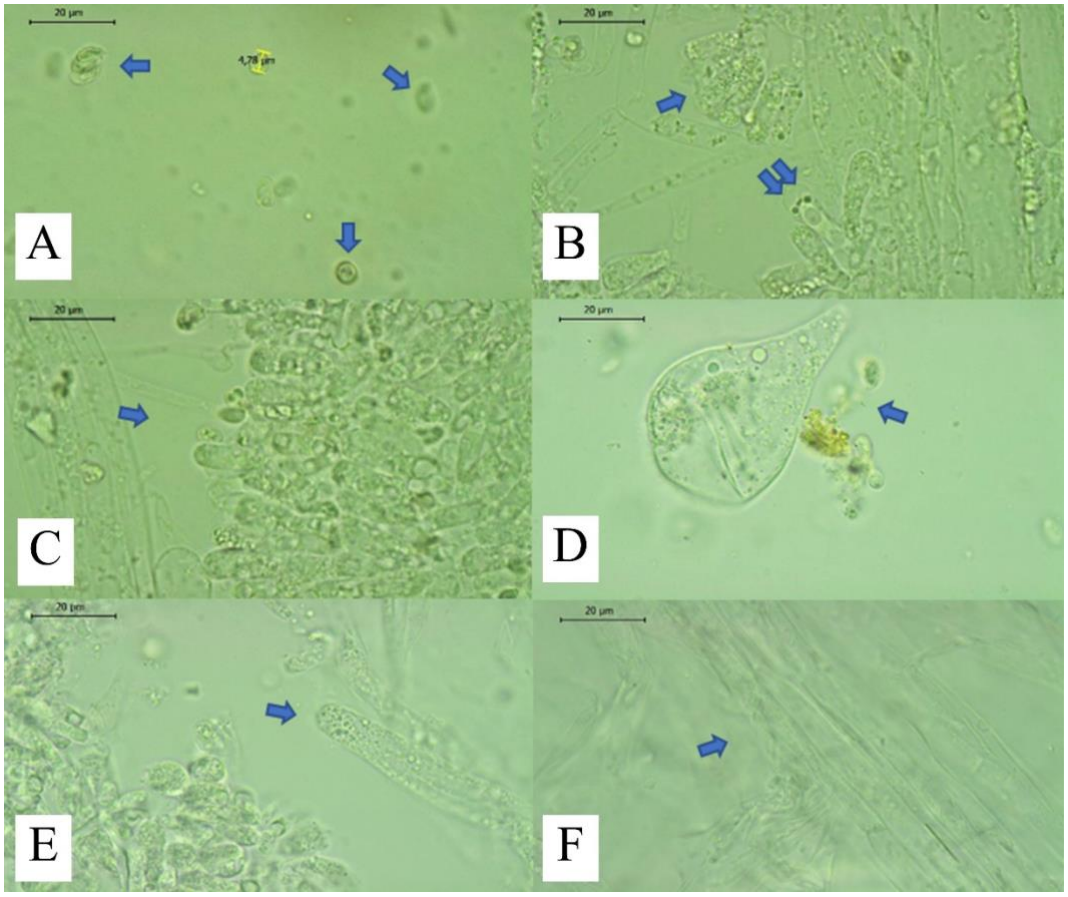

Figure 3. Micromorphological characters of Termitomyces striatus. (A) Basidiospores (arrow); (B) Basidia (arrow), basidia with sterigma and spore (double arrows); (C) Basidiole (arrow); (D,E) Cystidia (arrow); (F) Trama (arrow). Bars A-F = 20 µm.

The identification results based on the morphological characteristics of the fruit body indicate that the fungus obtained in this study is *Termitomyces* striatus based on the primary *Termitomyces* reference for the Southeast Asia region [9].

The identified *T. striatus* found at open places in the HKIU Bamboo Arboretum area, which is surrounded by various types of trees. The fruiting bodies found in humid habitat conditions at 22 - 25 °C. This temperature is favorable for fungal growth. According to [10], the optimum temperature for fungal growth is 22 ºC – 35 ºC. Our specimen found around wood, leaf litter, and grass. Previous research [5] stated that the habitat of fungi is generally found in soil, leaf litter, and rotting wood.

The Genus *Termitomyces* has been found in several areas in Indonesia, such as the Ulolanang

Kecubung Batang Nature Reserve, Central Java [7], Kedung Pacul Village, Klaten [11 and Bogor Botanical Gardens [5], but with very minimal information. Considering Indonesia's vast territory, the chance of discovering new species of *Termitomyces*, such as that found in Sri Lanka, namely *T. srilankensis* [12], is a must.

Termitomyces striatus was introduced by Heim [13] with several morphological variations. Mossebo [14] reported that *T. striatus* f. *Pileatus* has a characteristic pileus that is grayish orange when young and cocoa brown when mature. This character is different from *T. striatus* f. *Brunneus* which has a dark brown pileus color that does not change in maturity. These differences in morphological characters are likely caused by differences in environmental conditions that give rise to morphological plasticity. The specimens obtained in this study were *T. striatus* f. *Pileatus* based on morphological features. To determine the relationship between specimens of the same type found in Indonesia and those found in the world, it is necessary to carry out phylogenetic analysis in future research.

Based on morphological characters, the species collected in this study also have similarities with *T. eurhizus*, which has a grayish-brown hood color [9]. However, *T. eurhizus* has a slightly darker color in the middle of the pileus. In addition, *T. eurhizus* has a slightly larger pileus size, reaching 16 cm in diameter compared to *T. striatus* described in this study (4.6 cm).

In this study, the mushroom stalks that extended/rooted into the soil were not dismantled, so observations were not made on the termite nests. The *Termitomyces* lives in symbiosis with termites, so its growth pattern follows the presence of termite nests. Termites provide a constant and regular growth environment, while fungi are a source of nutrition for termites [15]. Because *Termitomyces* are well known as edible mushrooms, efforts to cultivate this mushroom in Indonesia are an excellent opportunity to help meet people's food needs. Moreover, this mushroom can be an alternative substitute for meat because of its high protein content and

delicious taste, and it also contains various minerals and vitamins [16-19].

CONCLUSION

This research provides the description and herbarium and identifying one of the edible wild mushrooms in the HKIU area. The identification results based on the morphological characteristics of the fruit body indicated that the mushrooms obtained was *Termitomyces striatus*. Research on this fungal species still needs to be continued to determine the potential of this wild edible mushroom.

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