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Development of Basidiomycota Fungi with The Concept of Integrated Forest Management

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Research Highlights

The development of Basidiomycota that is cultivated by utilizing space on the forest floor has not been done much, especially in Indonesia. The Basidiomycota found in Indonesia have very high diversity, but have not been explored so far. Basidiomycota fungi is an alternative as a source of natural nutraceuticals. This study aims to obtain Basidiomycota fungi isolates that have the potential as a nutraceutical source. As the first stage in this research, the activities carried out were exploration, isolation on culture media, and identification of fungi based on genotypic characters. The results of this research have found eight types of basidiomycota that have the potential to be a source of nutraceutical in the geulis mountain forest area of West Java Indonesia. The fungi identified based on their genotypic characters were *Pleurotus ostreatus*, *Ganoderma cf. resinaceum*, *Lentinula edodes*, *Vanderbylia fraxinea*, *Auricularia delicate*, *Pleurotus giganteus*, *Auricularia* sp., and *Tricholoma giganteum*.

Graphical Abstract



Figure 1. Fruiting body and mycelium colony of Basidiomycota class: (A) *P.ostreatus*; (B) *T.giganteum*; (C) *G cf. resinaceum*; (D) *L.edodes*; (E) *V.fraxinea*; (F) *A.delicate*; (G) *P.giganteus*; (H) *Auricularia* sp.

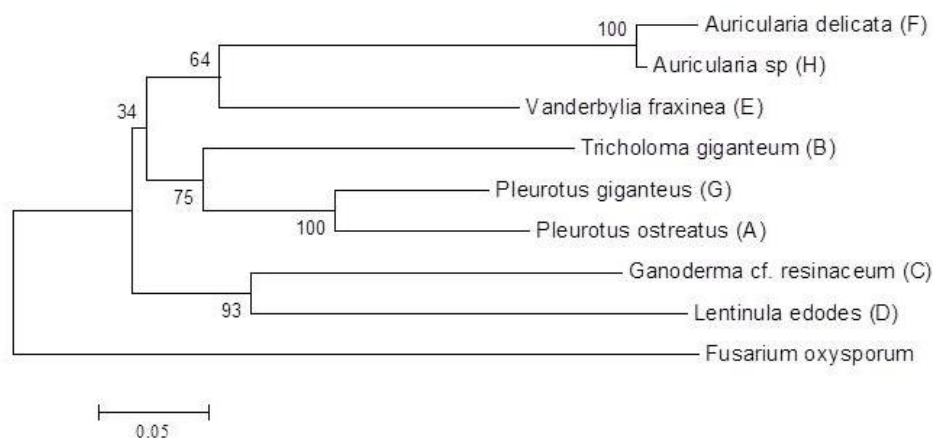


Figure 2. Dendrogram of phylogenetic analysis of Basidiomycota fungi based on ITS sequences using the neighbour joining method with 1000x bootstrap

Research Objectives

This study aims to obtain Basidiomycota fungi isolates that have the potential as a nutraceutical source. As the first stage in this research, the activities carried out were exploration, isolation on culture media, and identification of fungi based on genotypic characters.

Methodology

Fungal isolates

The fruiting body of the fungus found in the forest area of Geulis Mountain (Sumedang, Indonesia) was isolated by culturing the fruiting body of the fungi in-vitro on PDA (Potato Dextrose Agar). The fruiting body of the fungi is cut off by sterile knife. The sporocarp part was taken and planted in the PDA media. Characteristics of fungal morphology can be identified through fruiting bodies and colonization of hyphae in the roots (Brundrett, 2004).

DNA Extraction, Amplification and Sequencing

Identification of isolates is carried out by molecular method based on its DNA sequence. Genomic DNA extracted from hyphae from culture results using the modified method of CTAB (Cationic hexadecyl Trimethyl Ammonium Bromide). DNA isolation results then



carried out amplification with the technique of Polymerase Chain Reaction (PCR) use one primers pair, ITS4 (5'-CCCGCCTGACCTGGGGTCGC-3') as reverse primers and ITS5 (5'TAGAGGAAGGAGAAGTCGTAACAA-3') as forward primers. Determination of DNA base sequences is carried out in Macrogen, South Korea.

Phylogenetic Analysis

Phylogenetic analysis was carried out using character DNA, namely the nucleotide sequence from the ITS region. Phylogenetic trees are made using the Mega 5.05 program (Tamura et al., 2011).

Results

P.ostreatus has a broad, fan or oyster-shaped cap spanning 5–25 cm. Synytsya et al. (2009) reported that *P.ostreatus* are a source of glucans and can inhibit the biosynthesis of cholesterol, because it contains statins/lovastatin. *Auricularia* sp and *A.delicate* are called ear mushroom because the shape widened like a human ear and the color is generally black or blackish brown but some are dark brown. The fruiting body of *P.giganteus* has a brown, with brownish gills, and has been used as a culinary mushroom and medicinal properties. *L.edodes* has a brown lid to yellow-brown, with brownish gills. Surenjava, Zhang, Xua, Zhang, and Zeng (2006) reported that beta-glucans produced by *L.edodes* fungus had anti-tumor effects. The fruiting body of *V.fraxinea* is purplish red with white edges and the cap is wide and wavy. The fruiting body of the *V.fraxinea* is similar to *G cf. resinaceum*, but the color of *G cf. resinaceum* fruiting body is blackish brown with white edges. *T. giganteum* have a convex to flat cap and brownish color. Reported by Prakasam et al. (2011) that *T. giganteum* contains essential macros, micronutrients and antioxidant activity.

The genotypic character of *A. delicata* was similar to *Auricularia* sp. with a bootstrap value 100, while *P. giganteus* was similar to *P.ostreatus* with a bootstrap value of 100. *G cf. resinaceum* was similar to *L. edodes* with a bootstrap value 93. *V. fraxinea* is closely related to the genus *Auricularia* with a bootstraps value of 64, while *T. giganteum* is closely related to the genus *Pleurotus* with a bootstraps value of 75.





Findings

The results of this study have found eight types of basidiomycota fungi that have the potential to be a source of nutraceutical in the mountainous geulis forest area of West Java Indonesia. Based on the results of molecular identification of fungi that were successfully isolated are as follows, namely *Pleurotus ostreatus*, *Ganoderma cf. resinaceum*, *Lentinula edodes*, *Vanderbylia fraxinea*, *Auricularia delicate*, *Pleurotus giganteus*, *Auricularia sp.*, and *Tricholoma giganteum*.

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