Biodegradation on *Acacia mangium* Willd. and *Pinus merkusii* Jungh. et de Vriese with *Pleurotus* spp. Isolates

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ABSTRACT

White-rot fungi *Pleurotus* spp. was tested to identify the ability of the growth, the colonization and biodegradation on wood of *Acacia mangium* and *Pinus merkusii*. This research was carried out in the laboratory of Forest Pathology and Laboratory of Solid Wood, Faculty of Forestry, Bogor Agricultural University, Indonesia. The colonization and biodegradation process of wood that used in this experiment was trapping method. Physiological study was conducted to know the optimum growth of the fungi in glass bottle. Each glass bottle was filled with 40 ml MEA (Malt Extract Agar, with pH 6.0). The fungi was growth on MEA and incubated for eight days at room temperature (29 $\pm$ ^{o}C) and then eight chips of wood (2x3x0.5 cm) was filled in the bottle. The degradation level was counted based on the decreasing of dry weight of wood before and after trapping with the fungi. The incubation periods of trapping method were 0, 2, 4, 6, and 8 weeks. The result showed that the degradation level of *P. ostreatus* on *A. mangium* was higher than on *P. merkusii* at the same treatment. Commonly, the highest degradation level of the fungi on wood in this experiment was occurred two weeks after inoculation.

Key Words: *Pleurotus* spp., *P. ostreatus*, degradation, *Acacia mangium, Pinus merkusii*

INTRODUCTION

Forest with its biodiversity is a very important natural resources of Indonesia. Fungi as one of it, have not been optimized its potentials in Indonesia. *Pleurotus* spp. as one of white rot fungi can also be used as edible fungi, this fungi are able to degrade lignoselulose materials effective and efficiently. Therefore a research to determine degradation value of this fungi in woody species is needed.

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PURPOSE

The purpose of this research is to examine the *Pleurotus* spp. isolates degradation value on *A. mangium and P. merkusii* by means of wood dry weight and microscopic analysis on wood destruction.

METHOD

The research was done on June until December 2004 in Forest Pathology and Solid Wood Laboratory, Faculty of Forestry, IPB. The isolates were *Pleurotus* sp.1, *Pleurotus* sp.2, *Pleurotus* sp.3, *Pleurotus* sp.6, and *Pleurotus* sp.8, *Pleurotus* sp.10, *Pleurotus* sp.11, *Pleurotus* sp.12, *Pleurotus* sp.13, *Pleurotus* sp.14 and *Pleurotus* sp.15. Materials used are chips of *A. mangium* and *P. merkusii* (2.5-3.0 x 2.0-2.5 x 0.5 cm), and medium Malt Extract Agar. The method consist of 2 stages, preparation and examination. Preparation stage consist of chip making, fungi breeding, and fungi inoculation. Examination stage consist of wood placement on the fungi, visual and microscopic examination, and wood dry weight mensuration. There were 2 plots of wood placement. The first would need to be analysed every 2 weeks for 2 months analysis, while the other would need to be analysed only after 2 months analysis. Each plot consist of subplot with the combination of isolates and wood species. Each test had 2 repetition from 2 subplot, except from 2 months analysed subplot (16 repetition).

RESULTS AND DISCUSSION

Every isolates have different ability of degradation on *P. merkusii* and *A. mangium*. Some isolates (*Pleurotus* sp.1, 2, 3, 6, 8) resulted the higher degradation level on *A. mangium*, and the others (*Pleurotus* sp.10, 11, 12, 13, 14, 15) were on *P.*

merkusii. The highest degradation value on *A. mangium* was resulted from *Pleurotus* sp.6 (22.911%) for 8 weeks incubation, while on *P. merkusii* was resulted from *Pleurotus* sp.10 (21.207%) for 2 weeks incubation. The lowest degradation value on *A. mangium* was resulted from *Pleurotus* sp.11 (1.522%) for 4 weeks incubation, and also on *P. merkusii* was resulted from *Pleurotus* sp.11 (1.754%) for 4 weeks incubation.

It was expected that lignin composition and structure influenced degradation level. The reaction between mushroom and wood was influenced by type of mushroom, incubation period, and also the entire characteristic of origin wood, such as wood structure, specific gravity, amount and lignin type, and other component of wood (extractive compound, cellulose, hemicellulose, etc.).

Visual analysis showed that the color of wood surface of *P. merkusii* was becoming brighter in the incubation and vice versa in *A. mangium*. Since it has a brown extractive compound that emerged from wood. Microscopic analysis showed that in the early stage of fungi invasion on *P. merkusii*, mycelium lived in resin tunnel or xyllary rays, while on *A. mangium* they lived in vessels and xyllary rays. In general, mycelium penetrate through nocti as a means to spread further in another wood cells. Others, there were changes and cells damage of middle lamella and secondary wall cell in the early stage of decay.

(a) (b) (c)

Figure 1. Visual vision of wood *A. mangium* baited to *Pleurotus* sp.6 at incubation period: 2 weeks (a), 8 weeks (b), and wood as control (c), there are colonization of mycellium at wood surface (white arrow).

(a) (b) (c) (d)

Figure 2. Visual vision of wood *P. merkusii* baited to *Pleurotus* sp.10 at incubation period: 2 weeks (a), 6 weeks (b), 8 weeks (c), and wood as control (d), there are colonization of mycellium at wood surface (black arrow).

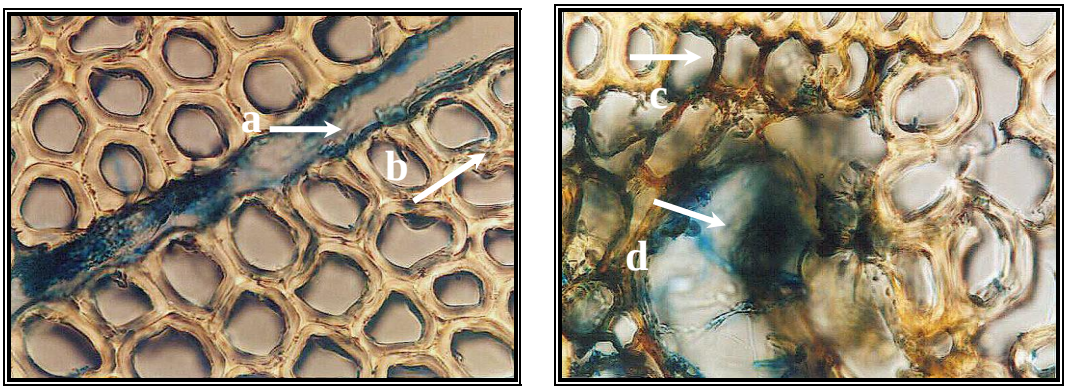


Figure 3. Transverse section of cells of *P. merkusii* baited to *Pleurotus* sp.8 after 2 weeks incubation (magnification 400x). There are colonization of mycellium in xillary tracheid (a) and resin tunnel (d), early decay at middle lamellae (b), loss of structure secondary cell walls (c).

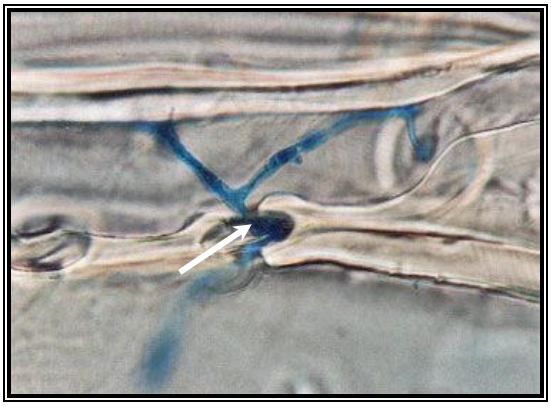
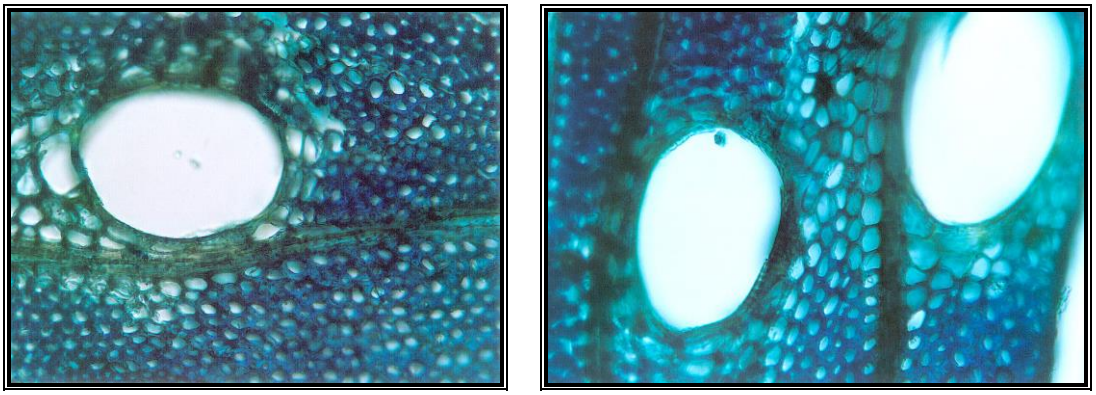


Figure 4. Radial section of cells of *A. mangium* baited to *Pleurotus* sp.10 after 4 weeks incubation. Mycellium penetrate cell walls through cell dot (magnification 400x).



(a) (b)

Figure 5. Transverse sections of cells of *P. merkusii* as control (a) and *A. mangium* as control (b) (magnification 400x). The cells are still intact.

CONCLUSIONS

Every isolates have different ability of degradation on *P. merkusii* and *A. mangium*. The highest degradation level on *A. mangium* resulted from *Pleurotus* sp.6 (22.911%) for 8 weeks incubation, while on *P. merkusii* resulted from *Pleurotus* sp.10 (21.207%) for 2 weeks incubation. There were two different types of decay in this research. First, fungi degraded wood starting from secondary wall cell to middle lamella. At the other type, fungi degraded wood starting from middle lamella, so that there was an empty space in middle lamella. One fungi isolate can degrade the wood by this two different type of decay.

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