Natural durability of raru wood (*Cotylelobium melanoxylon*) against subterranean termite attack

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Abstract. *Cotylelobium melanoxylon* or locally known as raru is one of the endemic species in North Sumatra. The species was disjunct distributed in Central Tapanuli Regency, North Sumatra. The purpose of this study was to analyze the wood durability of *C. melanoxylon* against termites’ attack by using the graveyard test method. Wood samples were made measuring 3 cm by 3 cm by 20 cm. The test sample was dried using an oven at 103 ± 2°C for 24 hours before and after the test. The graveyard test was carried out for 3 months (90 days). The test parameter observed was a weight loss of the sample. The results showed that *C. melanoxylon* wood was classified into durable class II and included in a resistant category with weight loss values ranging from 0.89 to 2.79% for axial direction and 1.81 to 2.22% for lateral direction.

1. Introduction

Indonesia is a high biodiversity country of flora and fauna including wood-destroying organisms. One of the most well-known wood-destroying organisms that provide substantial losses is termites. According to [1], cellulose and hemicellulose content of wood each range between 38 to 49% and 19 to 26% respectively, this is the main feed for termites. According to [1], termites are wood-eating insects (xylophagus) or materials consisting of cellulose. Several previous studies related to the durability of tropical wood against termite attacks had been carried out by [2-5]. In addition to the physical, mechanical, anatomical and chemical of wood, durability properties of wood against termite attack are very important to know because this will affect the wood's resistance in its use. In this study, raru wood was chosen because the basic data of wood durability is not available yet. The current study of this wood species is still focused on physical, mechanical and chemical properties.

Raru is a wild species that grows in tropics of the Asian maritime region. In Indonesia, raru is distributed in Sumatra Mainland and Kalimantan. Of five species in Cotylelobium genus, *C. melanoxylon* is found in Sumatra mainland and some small islands surrounding it [6]. In North Sumatra, the species was utilized as an alcoholic traditional drinking call *tuak* for increasing the fermentation rate [7,8]. Based on the results of a study conducted by [9] stated that raru wood is classified as strength class I wood because it has a specific gravity of up to one or even more. This wood has the potential to be used as raw material for construction. The limited data on the natural
durability of wood has encouraged this research to be carried out.

2. Materials and methods

2.1. Materials
The material for this study is raru wood obtained from Central Tapanuli, North Sumatra. The wood sample was divided into three parts in axial stem direction (base, middle, and tip) and three parts lateral stem direction (near the bark, midst, near pith). Then each wood was prepared for a test sample using 3 cm by 3 cm by 20 cm.

2.2. Methods
The observation carried out in the field using the graveyard test method. Before the graveyard test application, the sample was dried in an oven at 103 ± 2°C for 24 hours to get dry weight before testing. Furthermore, the sample was buried in the soil leaving 5 cm above of surface with a distance of 60 cm from the other test samples. After 3 months (90 days) of testing, a sample was taken and cleaned from the attached soil, then it was dried using an oven at 103 ± 2°C for 24 hours, so that dry weight is obtained after testing. Parameters observed were weight loss and percent damage based on classification of wood resistance against subterranean termite attack refers to [10].

3. Results and Discussion

3.1. Weight loss
Weight loss is an indicator of a test sample attacked by destroyer organisms that can affect the wood quality and expressed in units of a percent [11]. The weight loss value of wood-based on the axial and lateral direction of the stem was presented in figure 1. As shown in figure 1, there are variations in the weight loss value of samples tested at different stem positions. One of the factors influencing wood durability properties is wood position in the stem [12].

![Figure 1. Weight loss of raru wood based on axial direction (a) and lateral direction (b)](image)

Based on figure 1, the tendency of weight loss value was increasing from the base part to the tip of a stem. According to [13], the level of wood damage due to termite attack depends on wood species and stem position, the level of wood resistance from the base to tip tends to decrease. Meanwhile for the lateral direction of stem the tendency to weight loss increases towards the bark. In the position of a stem that was close to the pith, the proportion of the heartwood is greater than the trunks that are close to the bark. In general, heartwood has high natural durability because it contains extractive substances that are toxic [14]. Extractive substances have toxic properties that are useful to protect the wood from...
termite attack so that the higher level of extractive substances contained in wood results in the natural durability of wood is higher [15].

Although the relationship between specific gravity and durability is not clearly described, however in these study relationships between specific gravity and weight loss due to subterranean termite attacks was very high, it was indicated by the coefficient of correlation values which close to 1 (r = 0.999). The results of the study as presented in figure. 2, shows that there was a negative correlation between specific gravity and weight loss value where the lower wood specific gravity value resulted in higher weight loss value. Higher specific gravity has an effect on increasing of wood hardness which makes it more difficult for termites to eat wood. Similar result was also reported by [16] that difference in weight loss value was suspected to be 6-year-old acacia wood having a slightly higher density and specific gravity than 5-year-old and 7-year-old acacia wood.

![Figure 2. Correlation between specific gravity and weight loss of raru wood](image)

The results of the visual graveyard test showed that the level of termite attack was classified into B class, which was indicated slightly attacked, there were termite attacks such as bite marks with a depth of 12.5%. According to [17], the behavior of eating termites in the field depends on where the colony is located and several the existing population. In nature, termites are faced with many feed choices, in these circumstances’ termites will choose the most preferred type of feed and other feed sources would be abandoned

4. Conclusion
The natural durability of rau wood against subterranean termite attacks was classified into a durable class II and resistant category. Weight loss values ranging from 0.89 to 2.79% for axial direction and 1.81 to 2.22% for lateral direction.

5. References
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