

Durability test of local, usable wood against termites

by

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Abstract

A durability test of 12 local, usable wood specimens and 1 commercial wood were conducted using termite no-choice bioassay (ASTM D3345-74) under laboratory and a random-placement -field test. One-way ANOVA was used to examine the difference in percent weight loss among wood species. A difference in subterranean termite feeding rates were found in 5 wood species including Durian, Bamboo, Mango tree, Rubber wood and Eucalyptus ($P < 0.05$). Similarly, there was a difference in the percent weight loss among wood species ($F_{12, 64} = 49.3, P < 0.001$). Weight loss was significantly higher in 5 wood species, Durian ($43.2 \pm 8.3SE \%$), Bamboo ($46.1 \pm 9.8SE \%$), Mango tree ($70.9 \pm 7.1SE \%$), Rubber wood ($39.5 \pm 4.7SE \%$) and Eucalyptus ($53.3 \pm 9.1SE \%$), than the other species ($P < 0.05$). In laboratory, 10 replicates were prepared for each timber species. A difference in feeding rates of termites was found in 1 wood species, Mango tree ($P < 0.05$). Difference in the no-choice test weight loss was also found among wood species ($F_{12, 64} = 49.3, P < 0.001$), with weight loss significantly higher in 2 wood species, Mango tree ($11.8 \pm 1.9SE \%$) and Rubber wood ($10.2 \pm 1.4SE \%$) ($P < 0.05$).

Keyword: Durability, local, usable woods, termites

Introduction

The termites are known to cause losses in agriculture and forest as well as to wooden structures resulting in expensive property damage in a short time (Bultman and Southwell, 1976). Today, chemicals are used to control termites around residents by termite control businesses. Environmental pollution concern caused by the use of toxic chemicals, is resulting in the search for natural compounds as alternative termiticides (Carter, 1976, Ganapaty *et al.* 2004, Roszaini *et al.* 2009). The special properties of natural wood such as secondary metabolite, quinines, flavonoids and terpenoids (Scheffrahn, 1991, Balsiger *et al.* 2000), are thought to provide protection against wood damaging fungi, insects and other organisms (Hon and Shiraishi, 1991, Schultz and Nicholas, 2002). Other components from extractives, to wood density have been found to affect termites feeding (Bultman *et al.* 1979).

Humans have for many years used chemicals for termite control and today the service charge of termite control companies is dependent on chemicals used and type of wood to be protected. One objective of this study was to supply background information on the natural durability of different types of usable woods against termite damage. This study focused on wood consumption rates of termites offered different types of wood. The wood that we found to be seriously damaged by termites would be one good choice to use in termite control businesses.

In 1989, the government of Thailand declared a blockade on wood products from forests (Chairat, 2015) that meant the people and companies couldn't use Thai wood to build or decorate dwellings nor could Thai wood be exported to other countries. Therefore, the best choices are used woods from plantation forests, agricultural fields and garden trees that ordinary people can apply to use. Secondary objective, the high natural resistance of woods that were used in the buildings and wooden makings to decorated the facilities.

Materials and methods

1. Wood types

Wood from a total of 13 different tree species were used including: Rubber wood (*Hevea brasiliensis*); Eucalyptus (*Eucalyptus camaldulensis*); Gurjin (*Dipterocapus* sp.); Neem Tree (*Azadiracta indica*); Mango tree (*Mangifera indica*); Bamboo (*Bambusa* sp.); Durian (*Durio zibethinus*); Casuarina (*Casuarina junghuhniana*); Siamese Sal (*Shorea obtuse*); Indian Walnut (*Albizia lebbeck*); Teak (*Tectona grandis*); Iron wood (*Xylia xylocarpa*) and Commercial lumber (*Pinus* sp.) was used as a control.

2. Field Test

Five circular test blocks measuring 70-cm in diameter were random take placed at the Technology Development and Transfer Division station in Ratchaburi Province. Thirteen wood specimens were cut into blocks measuring 25-mm in thickness, 100 mm in length, and 25 mm in width. All wood specimens were dried under 100 ± 5 °C in 24 hours and dry weight recorded. Five replicates were prepared for each timber species with the test wood specimens placed above cement pads in each circular test block. At the end of six months the specimens were removed, cleaned, dried for 24 hours and reweighed.

3. No-choice laboratory test

Twelve wood specimens were random taken from sawmills and cut into by 6.4 mm thick, 25.4 mm length, and 25.4 mm width blocks, and including the Commercial wood (*Pinus* sp.) controls. All wood specimens were dried at 100 ± 5 °C for 24 hours and dry weight recorded. Ten replicates were prepared for each timber species and subjected to termite bioassays according to the no-choice test procedure of ASTM D3345-74 (ASTM, 1988).

Termites were collected from the field using wood board traps and then maintained in a termite cement tank for approximately 4-6 weeks. Cups measuring 10-cm diameter by 8-cm high were filled with 100 g of sterilized sand and 30 ml distilled water. The cups were left overnight to equilibrate to laboratory conditions before test initiation. Each type of timber was placed on the surface of the sand in a cup and then 1 g (approximate 400 termites; 320 workers and 80 soldiers) termites were added to constitute a replication. At the end of four weeks the timbers were removed, cleaned, dried around 24 hours and reweighed.

4. Data analysis

One-way ANOVA is used to examine differences in the percentage weight loss among wood species under the field tests, as well as the no-choice laboratory bioassay. A general linear model (univariate) was performed to determine significant differences in weight before and after exposure to termites, between and among wood species. Data collection was log transformed to test homoscedastic assumptions of normal distribution. When ANOVA revealed a statistically significance difference between wood species ($P<0.05$), a Turkey HSD test was performed for each wood species as a post-hoc comparison. All statistical analyses were performed using SPSS 20.0 software package for windows (SPSS Inc., Chicago, USA).

Results

1. Field tests

Significantly different wood weigh loss rates before and after termite attack under field tests was affected by tree species ($F_{12, 104} = 18.1$, $P< 0.001$; Figure 1). A large difference in termite feeding rates were found in the following five wood species Durian, Bamboo, Mango tree, Rubber wood and Eucalyptus ($P<0.05$). Similarly, there was a difference in the percentage weight loss among wood species ($F_{12, 64} = 49.3$, $P< 0.001$; Figure 2). Percent weight loss was significantly higher in the same five wood species, Durian ($43.2 \pm 8.3SE$ %), Bamboo ($46.1 \pm 9.8SE$ %), Mango tree ($70.9 \pm 7.1SE$ %), Rubber wood ($39.5 \pm 4.7SE$ %) and Eucalyptus ($53.3 \pm 9.1SE$ %), than the other species ($P<0.05$).

2. No-choice laboratory test

A significant difference in termite feeding rates under no-choice laboratory tests were affected by plant species ($F_{12, 234} = 73.2$, $P< 0.001$; Figure 3). A large difference in termite feeding rates was found in one wood species, Mango tree ($P<0.05$). A difference in weight loss was also found among wood species ($F_{12, 64} = 49.3$, $P< 0.001$; Figure 4), with weight loss significantly higher in two wood species, mango tree ($11.8 \pm 1.9SE$ %) and Rubber wood ($10.2 \pm 1.4SE$ %) ($P<0.05$).

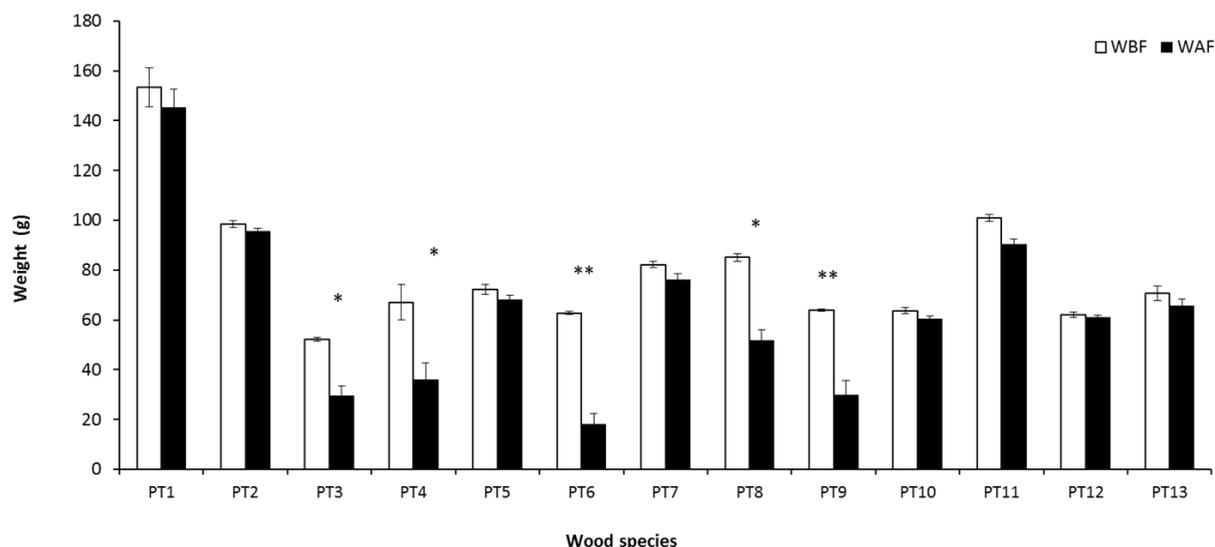


Figure 1 Comparison the wood weight before termite attack (WBF) and after termite attack (WAF) for each wood species from the field tests. Statistical differences between means are indicated by an asterisk (* = $P < 0.05$ and ** = $P < 0.001$). The wood species abbreviation are: PT1 = Iron wood, PT2 = Siamese Sal, PT3 = Durian, PT4 = Bamboo, PT5 = Indian Walnut, PT6 = Mango tree, PT7 = Keruing, PT8 = Rubber wood, PT9 = Eucalyptus, PT10 = Neem tree, PT11 = Casuarina, PT12 = Teak and PT13 = Pine wood (commercial wood).

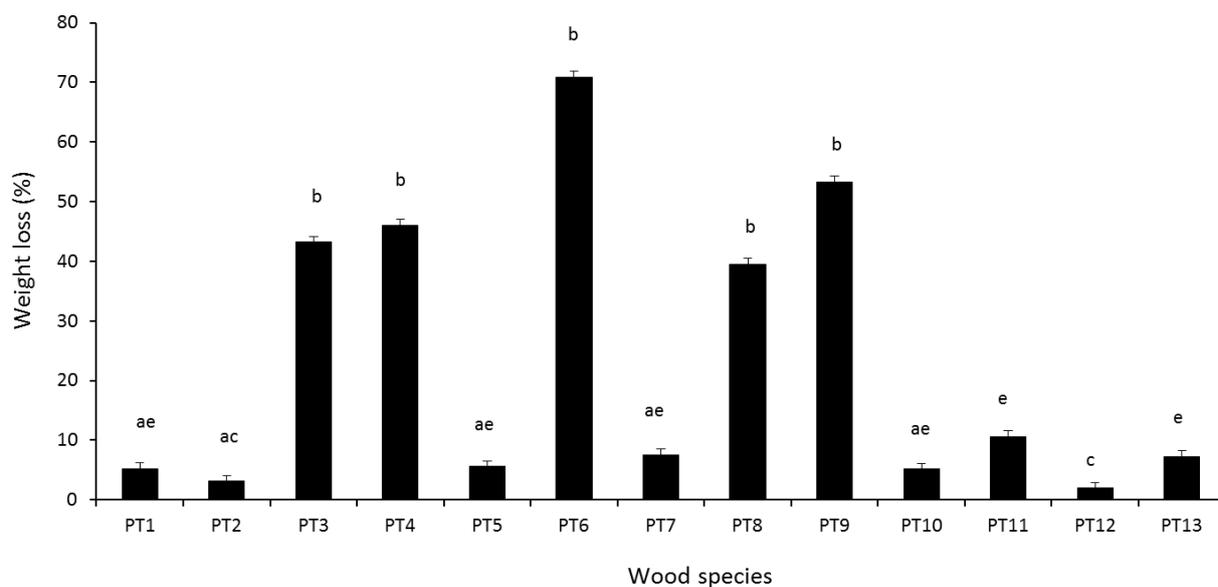


Figure 3 Change in percentage weigh loss in difference wood species from the field tests. Different lower case letters indicate a significant difference among wood species ($P < 0.05$). The wood species abbreviations see in Figure 1.

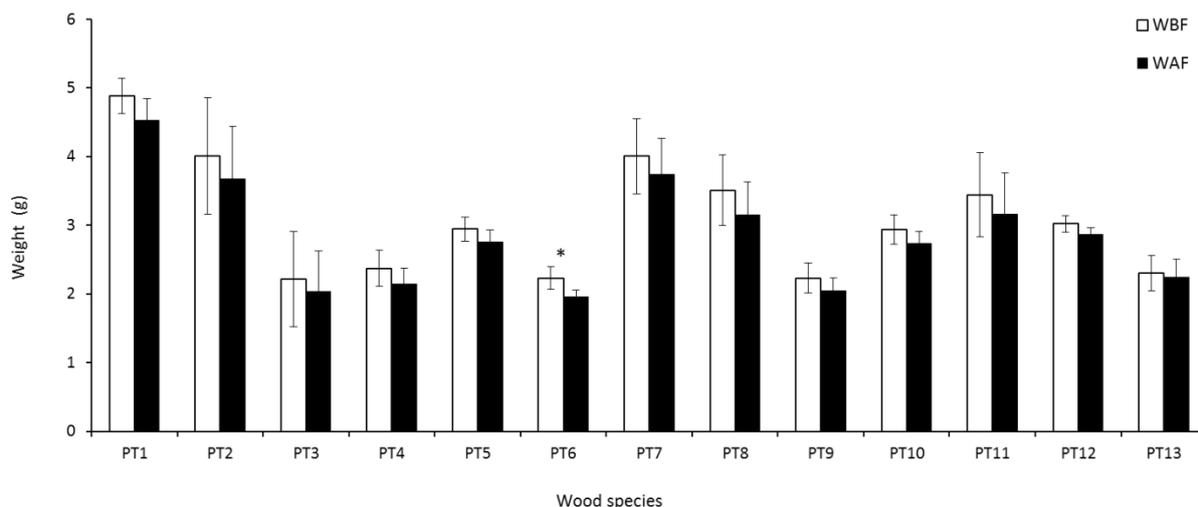


Figure 2 Comparison wood weight before termite attack (WBF) and after termite attack (WAF) of each wood species under no-choice laboratory tests. Statistical difference between means are indicated by an asterisk (* = $P < 0.05$). The wood species abbreviations see in Figure 1.

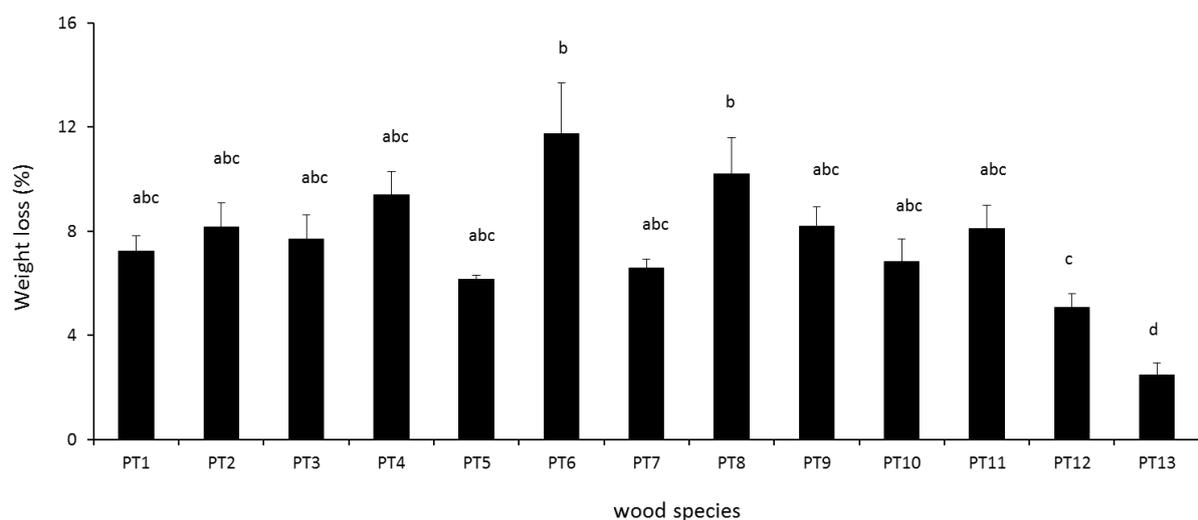


Figure 4 Change in percentage of weigh loss in difference wood species from no-choice laboratory tests. Different lower case letters indicate a significant difference among wood species ($P < 0.05$). The wood species abbreviations see in Figure 1.

Discussion

The results presented herein show that the feeding rates of termites under field test conditions was greatest in five wood species, Durian, Bamboo, Mango tree, Rubber wood and Eucalyptus. Significant weight loss was also found in those wood species with respect to termite damage. Interestingly, termite feeding rates under no-choice laboratory bioassay was greatest in Mango tree, while significant weight loss was found in both Mango tree and Rubber wood.

All of those results indicated that Mango tree and Rubber wood might be an acceptable food for termites as indicated by a higher feeding rate and percentage wood weight loss in both field and no-choice laboratory tests. Thus, we would encourage that those wood species be used in wood-particle toxic baits for controlling termites.

Acknowledgements: The authors are very grateful to Mr. Khwanchai Charoenkrung for his kindness to suggest how to collect termites from field and bring up for the laboratory tests and the Technology Development and Transfer Division station in Ratchaburi Province for providing the place to field-test.

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