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NATURAL DURABILITY OF TWENTY TWO MALAYSIAN COMMERCIAL TIMBERS

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Introduction

Durability is defined as the ability of a material to withstand environmental stress over an extended period of time. Timber which is a ligno-cellulosic material is liable to degradation due to biological agents such as insects (eg. termites), fungi, bacteria etc. Among these biological agents, termites and fungi cause significant losses not limited to tropical and subtropical countries, but also in some northern parts of the world. Both cause more damage to timber buildings than fire.

Timber consists of two parts which are called sapwood and heartwood. Sapwood of many tree species has no natural resistance (Toole 1970) and thus susceptible to fungus attack. Whereas for certain timber species, the heartwood has a natural resistance due to the presence of extractive substances that are formed during the growth process. It is a protective material to the timber-damaging agents. The natural durability of woods may vary among tree species, among individual trees, and within individual trees (Scheffer and Cowling 1966).

This paper reports on entomological as well as mycological assessment of twenty two Malaysian timber species. It gives the comparison regarding the natural durability classification for the users of Malaysian timber to make decision during procurement.

Natural durability rating

The durability of timber, or the natural resistance of timber against biodeterioration agents; fungi and termite, is an extremely variable property. The natural resistance rating is a form of measure of resistance against rotting, insects and marine borer attacks. This rating is made due to the problem in the classification of timber species which vary by country. The rating is not intended to predict a precise life expectancy of a species due to the variability within a species and due to the differences in conditions between sites and applications where the timber species might be used.

Figure 1 Sample of a pole attacked by fungus

Materials

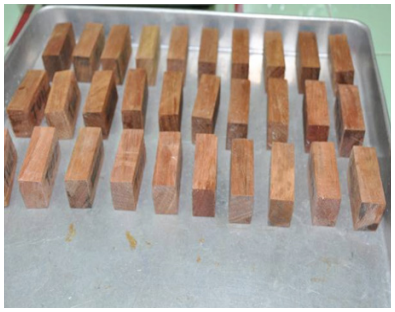
Twenty two (22) Malaysian commercial timber species as listed in Table 1 were collected from a forest in Terengganu for this study. In addition, two imported reference species were included: Beech (for fungal test) and *Pinus* sp. (for termites test). Each test specimen came from 3 different trees.

Figure 2 One of the timber species (kapur) used for this study

Table 1 Timber species evaluated

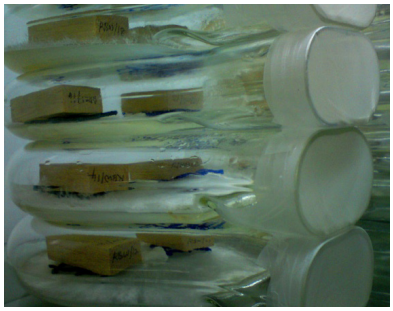
No.	Species	Scientific name
1	Akasia	*Acacia mangium*
2	Binuang	*Octomeles sumatrana*
3	Geronggang	*Cratoxylum arborescens*
4	Gerutu	*Parashorea* spp.
5	Jelutong	*Dyera costulata*
6	Kapur	*Drybalanops aromatica*
7	Kedondong	*Canarium* spp.
8	Kekatong	*Cynometra malaccencis*
9	Kelat	*Syzigium* sp.
10	Keledang	*Artocarpus* sp.
11	Kelempayan	*Neolamarckia cadamba*
12	Keruing	*Dipterocarpus* spp.
13	Kulim	*Scorodocarpus borneensis*
14	Machang	*Mangifera indica*
15	Medang	*Cinnamomum* spp.
16	Mengkulang	*Heritiera* spp.
17	Meranti bukit	*Shorea platyclados*
18	Meranti sarang punai	*Shorea parvifolia*
19	Mersawa	*Anisoptera* sp.
20	Pelong	*Pentaspadon velutinus*
21	Sesenduk	*Endospermum malaccense*
22	Tembusu	*Fagraea fragrans*
23	Beech (fungus reference species)	*Fagus sylvatica*
24	Southern yellow pine (termite reference species)	*Pinus* spp.

Fungus test



(a) Timber specimens for fungus test

(b) Conditioning of timber specimens



(c) Exposure test of timber specimens to fungi in the conditioning room

Figure 3 Preparation of timber specimen for test against fungi (EN 350-1)

Laboratory test using EN 113:1996

The durability test and classification against fungus were done based on the European standard EN 113 (1996). The fungus used was *Coriolus versicolor* (Linnaeus) Quelet (CTB 863 A) (CV) (white-rot fungi). The evaluation of the decay rate was performed according to the grading system of EN 350-1 (Table 2). An x value for each timber species was calculated by dividing the average weight loss of each timber species with the average weight loss of reference timber (beech).

Table 2 Durability classification of timbers based on exposure to fungus as specified in BS EN 350-1 (1994)

Durability class	x value (EN 350)	Description
1	≤ 0.15	Very durable
2	$0.15 < x \leq 0.30$	Durable
3	$0.31 < x \leq 0.60$	Moderately durable
4	$0.61 < x \leq 0.90$	Slightly durable
5	> 0.9	Not Durable

Termites test

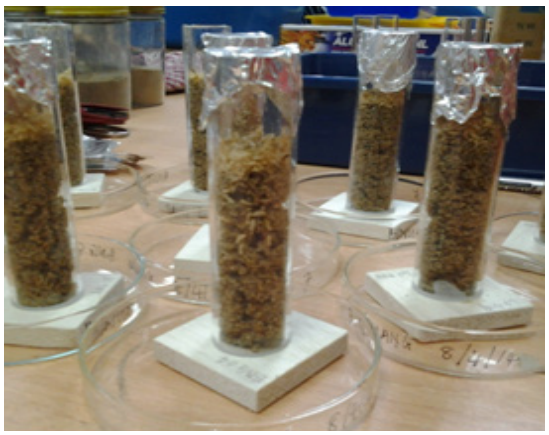
Laboratory test using EN 118:2005

The test method adopted was European Standard EN118 (2005), using Asian subterranean termite (*Coptotermes curvignathus* Holmgren) (Figure 4b). Each timber specimen was examined and visually rated using a standard rating system as shown in Table 3 and the durability rating as shown in Table 4.

(a) Termite trapping

(b) Soldiers and workers of termites

(c) Separation of termites between soldiers and workers



(d) Arrangement of timber specimens for EN118 test

Figure 4 Preparation of wood samples for test against termites (EN118: 2005)

Table 3 Visual assessment rating of termite attacks, according to EN118:2005

Rating	Description
0	No attack
1	Attempted attack: i. Superficial erosion of insufficient depth to be measured on an unlimited area of the test specimen; or ii. Attack to a depth of 0.5 mm provided that this is restricted to an area or areas not more than 30 mm^2 in total; or iii. Combination of i) and ii)
2	Slight attack: i. Erosion of 1 mm in depth limited to not more than 1/10 of the surface area of the test specimen; or ii. Single tunneling to a depth of up to 3 mm; or iii. Combination of i) and ii)
3	Average attack: i. Erosion of < 1 mm in depth over more than 1/10 of the surface area of the test specimen; or ii. Erosion of > 1 mm to < 3 mm in depth limited to not more than 1/10 of the surface area of the test specimen; or iii. Isolated tunneling of a depth > 3 mm not enlarging to form cavities; or iv. Any combination of i), ii) or iii)
4	Strong attack: i. Erosion of > 1 mm to < 3 mm in depth of more than 1/10 of the surface area of the test specimen, or ii. Tunneling penetrating to a depth > 3 mm and enlarging to form a cavity in the body of the test specimen, or iii. Combination of i) and ii)

Table 4 Classes of natural durability of timber to termite attack based on EN350-1 (1994)

Durability class	Description	Average rating
D	Durable	0-1
M	Moderately durable	2
S	Susceptible	3-4

Results

The result of fungus and termite tests are tabulated in Tables 5 and 6, respectively.

Table 5 Durability classes of 22 Malaysian timbers against fungus based on BS EN 350-1

Species	x value	Durability rating	Description
Akasia	0.3199	3	Moderately Durable
Binuang	0.3691	3	Moderately Durable
Geronggang	0.2191	2	Durable
Gerutu	0.2605	2	Durable
Jelutong	0.5267	3	Moderately Durable
Kapur	0.3746	3	Moderately Durable
Kedondong	0.2984	2	Durable
Kekatong	0.4560	3	Moderately Durable
Kelat	0.3420	3	Moderately durable
Keledang	0.2428	2	Durable
Kelempayan	0.1823	2	Durable
Keruing	0.4169	3	Moderately Durable
Kulim	0.4416	3	Moderately Durable
Machang	0.2491	2	Durable
Medang	0.2481	2	Durable
Mengkulang	0.3157	3	Moderately Durable
Meranti bukit	0.2846	2	Durable
Meranti sarang punai	0.2251	2	Durable
Mersawa	0.2181	2	Durable
Pelong	0.2914	2	Durable
Sesenduk	0.4960	3	Moderately Durable
Tembusu	0.3301	3	Moderately Durable
Beech			Moderately Durable

Notes: Mean of 30 replicates for each species

Table 6 Visual rating and durability classes of 22 Malaysian timbers and *Pinus* spp. against termites according to EN118 (2005)

Scientific name	Visual rating	Durability class
Akasia	4	Susceptible
Binuang	4	Susceptible
Geronggang	4	Susceptible
Gerutu	3	Susceptible
Jelutong	4	Susceptible
Kapur	2	Moderately durable
Kedondong	2	Moderately durable
Kekatong	1	Durable
Kelat	3	Susceptible
Keledang	3	Susceptible
Kelempayan	4	Susceptible
Keruing	3	Susceptible
Kulim	2	Moderately durable
Machang	4	Susceptible
Medang	1	Durable
Mengkulang	4	Susceptible
Meranti bukit	4	Susceptible
Meranti sarang punai	4	Susceptible
Mersawa	3	Susceptible
Pelong	4	Susceptible
Sesenduk	4	Susceptible
Tembusu	4	Susceptible
Pinus spp.	4	Susceptible

Notes: Mean of 10 replicates for each species. 0 = no attack, 1 = attempted attack, 2 = slight attack, 3 = average attack and 4 = strong attack.

Acacia mangium (4)

Octomeles sumatrana (4)

Cratoxylum arborescens (4)

Parashorea spp. (3)

Dyera costulata (4)

Drybalanops aromatica (2)

Cynometra malaccensis (1)

Canarium sp. (2)

Syzigium sp. (3)

Artocarpus spp. (3)

Neolamarckia cadamba (4)

Dipterocarpus spp. (3)

Figure 5 Examples of attacked area of 22 Malaysian timber species and *Pinus* spp. exposed to *C. curvignathus* according to EN118:2005. Numbers in paranthesis are visual assessment rating assigned to the sample

Continued

Continued Figure 5

Scorodocarpus borneensis (2)

Mangifera indica (4)

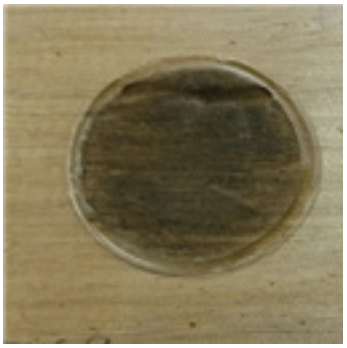
Cinnamomum spp. (1)

Heritiera spp. (4)

Shorea platyclados (4)

Shorea parvifolia (4)

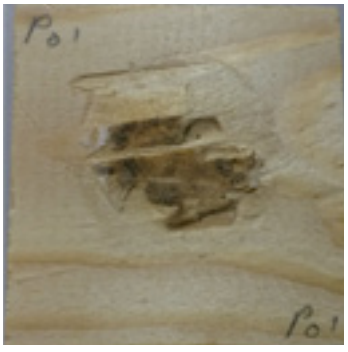
Anisoptera sp. (3)



Pentaspadon velutinus (4)

Endospermum malaccense (4)

Fagraea fragrans (4)



Pinus spp. (4)

Conclusions

This study has shown that most of the Malaysian timber species examined are naturally resistant against fungi, while on the other hand only some species are naturally resistant to the ravaging attack of subterranean termites. All of the twenty two Malaysian timber species have demonstrated to be superior in decay resistance as compared to the beech wood. With regard to termite resistance, however, only 5 Malaysian timber species are better than *Pinus* spp. i.e. 2 species fall under durable class and 3 species under moderately durable.

References

EN 113. 1996. Wood preservatives - Test method for determining the protective effectiveness against wood destroying basidiomycetes - Determination of toxic values. European Committee for Standardization (CEN), Brussels, Belgium, 31 p.

EN 118. 2005. Wood preservatives, Determination of preventive action against *Reticulitermes* species (European termites) (laboratory method). USDA Forest Service, Washington DC. 466 p.

EN 350-1 (1994) Durability of wood and wood-based product- Natural durability of solid wood- Part 1: Guide to the principles of testing and classification of the natural durability of wood. *European Committee for Standardization, Brussels, Belgium.*

Scheffer TC & Cowling EB. 1996. Natural resistance of woof to microbial deterioration. Annual Review of Phytopathology 4: 147–168.

Toole ER. 1970. Variation in decay resistance of southern pine sapwood. Forest Products Journal 20(5): 49–50.

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TTB53	Focus on Forest Products
TTB54	Wood Properties of Selected Plantation Species: *Tectona grandis* (teak), *Neolamarckia cadamba* (kelempayan/laran), *Octomeles sumatrana* (binuang) and *Paraserianthes falcataria* (batai)
TTB55	Identification Of Selected Lesser-Known Timber 13: angsana/sena (*Pterocarpus* sp.), bayur (*Pterospermum* spp.), bebuta (*Excoecaria* spp.) and kekabu (*Bombax* spp.)
TTB56	Malaysian timbers for Marine Scaffold Board Application
TTB57	Timber Properties and utilisation: Compilation of Timber Technology Bulletins 1995–2015
TTB58	Janka Hardness Rating of Malaysian Timbers
TTB59	Cross-Laminated Timber: Production of Panel Using Sesenduk Timber Species
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