DECAY RESISTANCE OF *ACACIA MANGIUM* HEARTWOOD AGAINST BROWN-AND WHITE-ROT FUNGI: PRELIMINARY RESULTS

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SALMIAH UJANG & AMBURGEY, T.L. 1993. Decay resistance of *Acacia mangium* heartwood against brown- and white-rot fungi: preliminary results. The decay resistance of the outer heartwood of *Acacia mangium* from two sources was evaluated against the white-rot fungus *Coriolus versicolor* and the brown-rot fungus *Gloeophyllum trabeum.* The outer heartwood of *A. mangium* from Ulu Sedili was found to be non-resistant and that from Kemasul was determined to be moderately resistant. The study indicated a variation in the decay resistance of *A. mangium* from the two sources.

Key words: *Acacia mangium* - decay resistance - *Coriolus versicolor* - *Gloeophyllum trabeum*

SALMIAH UJANG & AMBURGEY, T. L. 1993. Kerintangan kayu teras *Acacia mangium* terhadap kulat-kulat pereput perang dan putih: keputusan awal. Kerintangan bahagian luar kayu teras *Acacia mangium* yang tidak diawet dari dua kawasan berlainan terhadap kulat-kulat pereput putih, *Coriolus versicolor* dan pereput perang *Gloeophyllum trabeum* adalah dikaji. Bahagian luar kayu teras *A. mangium* dari Hulu Sedili didapati mempunyai darjah kerintangan yang lebih rendah berbanding sampel-sampel *A. mangium* dari Kemasul. Kajian ini menunjukkan adanya perbezaan dari segi daya tahan kereputan *A. mangium* dari dua tempat yang berbeza.

Introduction

Acacia mangium, a fast-growing hardwood (Family: Leguminosae, sub-family: Mimosoideae), native to North Queensland, Australia, was first introduced to Sabah, Malaysia in 1966 (Logan & Balodis 1982). This species has been selected as the principal species for the reforestation programme by the Department of Forestry of Malaysia (Johari & Hashim 1984) because it grows on a variety of sites and can be established on formerly forested areas (Khamis & Ghazali 1984).

The properties of *Acacia mangium* wood properties make it suitable for several uses including furniture, plywood, particleboard, door frames, window parts, firewood, charcoal and pulp.The wood is light (density ranging from 0.380-0.480 $g\ cm^{-3}$) characterized by relatively low strength properties (Peh & Khoo 1984).

Acacia mangium is affected by some fungal diseases and pests such as pinhole borers, carpenter ants and subterranean termites (Anonymous 1983).

The specific objective of this study was to evaluate and compare the resistance of the *Acacia mangium* wood from Kemasul, Pahang and Ulu Sedili, Johore to brown and white-rot fungi.

Materials and methods

Acacia mangium was compared to *Liquidambar styraciflua* (sweetgum) and *Pinus* sp. (southern pine), species native to the United States, in a series of tests. Three *A. mangium* boards of size 2.5 *ft* × 6 *in* × 1 *in* (76.2 × 15.2 × 2.5 *cm*) were supplied from Ulu Sedili and Kemasul plantations, Malaysia. Defect-free specimens used in the tests were chosen from the outer heartwood regions of *A. mangium* trees of age seven years and five years from the Ulu Sedili and Kemasul plantations respectively.

Gloeophyllum trabeum (Pers. ex Fr.) Murr. (Madison 617, ATCC No. 11539), a brown rot fungus, and *Coriolus versicolor* (L. ex Fr.) Quel. (Madison 697, ATCC No. 12679), a white rot fungus, were used as the bioassay organisms in decay tests. These organisms have been widely used in tests for natural decay resistance in other temperate and tropical wood species (Highley & Scheffer 1970a).

Forty test blocks of dimensions 25 × 25 × 9 *mm* (radial, tangential, longitudinal) were cut from the outer heartwood of *A. mangium.* Sixteen sweetgum (*L. styraciflua*) reference blocks were used in tests with the white-rot fungus *C. versicolor,* and sixteen *Pinus* sp. reference blocks with the brown-rot fungus *G. trabeum.* These reference blocks were subjected to decay at the same time as the test blocks, and the progress of their decay was used as a guide for terminating the incubation of *A. mangium* blocks exposed to the respective fungi.

The decay test was conducted according to procedures outlined in ASTM Standard D2017-81 (ASTM 1989) with exceptions as noted below. Sweetgum sapwood was used as feeder strips in decay chambers inoculated with *C. versicolor,* and southern pine as feeder strips in those inoculated with *G. trabeum.* The sapwood feeder strips were laid flat on the soil surface in each bottle. The bottles with the feeder strips were loosely capped and steam-sterilized at 121° *C* for 30 *min* on two consecutive days. After cooling, the feeder strips in each bottle were inoculated with one of the test fungi.

Before use in tests, all blocks were oven-dried at 105°*C*, weighed and conditioned to constant weight in a conditioning room at 30°*C* and 50% relative humidity. The test blocks were then steam-sterilized and placed on the fungus-covered feeder strips in the bottles inoculated with *G. trabeum.* Since the standard soil-block method frequently does not permit adequate wetting of blocks for optimum growth of white-rot fungi, blocks were buried below the feeder strips in decay chambers inoculated with *C. versicolor* (Highley & Scheffer 1970b). These bottles were incubated at 27° *C* and 70% relative humidity.

Testing was terminated at nine weeks for *G. trabeum* (ASTM D2017) and ten weeks for *C. versicolor* (modified ASTM D2017) when the reference blocks gave 60% weight loss.

The percentage weight loss due to decay was computed from the difference between the initial and final weights of each block.

Definition of the classes was based on the weight loss criteria developed and used in previous testing of a number of woods (ASTM 1989).

Results and discussion

The mean per cent weight losses due to decay by *G. trabeum* and *C. versicolor* of *A. mangium* (from both Ulu Sedili and Kemasul plantations), *Pinus* sp. and *L. styraciflua* are given in Table 1.

Table 1. Average weight loss of individual blocks of *A. mangium* (from Ulu Sedili and Kemasul), and reference blocks (*Pinus* sp. and *L. styraciflua*) when exposed to *Gloeophyllum trabeum* and *Coriolus versicolor* in a soil-block test

Fungus	Wood species	Av. wt. loss %	Std. dev.
Gloeophyllum trabeum	*A. mangium* (Ulu Sedili)	46.72	7.10
	A. mangium (Kemasul)	34.40	4.45
	Pinus sp.	54.05	11.48
Coriolus versicolor	*A. mangium* (Ulu Sedili)	32.96	6.32
	A. mangium (Kemasul)	27.59	5.30
	L. styraciflua	56.66	4.89

Substantial variation in decay resistance was observed among the wood species (Table 1). The high weight losses observed in the controls (*L. styraciflua* and *Pinus* sp.) indicated that the soil-block decay chambers provided conditions highly favourable for decay by both test fungi. Analysis of the results to compare the two *A. mangium* sources showed a significant difference between the samples from the two sites with respect to decay caused by the brown-rot fungus *G. trabeum* and the white-rot fungus *C. versicolor* (Table 2).

Table 2. Analysis of variance of dependent variables site *A. mangium* (Ulu Sedili & Kemasul) and treatment (*G. trabeum* and *C. versicolor*) in the soil-block test (ASTM 1989)

Source of variation	df	Sum of squares	Mean square	F	Pr>F
Site	1	781.81	781.81	22.63	0.0001*
Treatment	1	1058.02	1058.02	30.62	0.0001*
Site X Treatment	1	120.69	120.69	3.49	0.0698 ns

* significant at the 0.05 level; ns not significant.

Table 3 presents the proportion of samples in different resistance classes to show the variation in decay resistance. The rate and percentage of weight loss caused by decay of *A. mangium* from both sources was significantly different for white-rot and brown-rot fungi.

The average weight losses of *A. mangium* from Ulu Sedili were 46.7% and 33.0% for *G. trabeum* and *C. versicolor* respectively. The average weight losses of *A. mangium* from Kemasul by these fungi were 34.4% and 27.6% respectively (Table 1). This places *A. mangium* outer heartwood from Ulu Sedili in the non-resistant class and that from Kemasul in the moderately resistant class.

Table 3. Distribution of weight loss and resistance classes of samples of outer heartwood from two sources of *A. mangium* (Ulu Sedili and Kemasul), and sapwood of *Pinus* sp. and *L. styraciflu* after exposure to a *G. trabeum* and *C. versicolor* in the soil-block test

Wood species	Weight loss and resistance class			
	0 - 10% Very resistant	11 - 24% resistant	25 - 44% Moderately resistant	> 44% Non-resistant
	% of samples			
	Decay by *G. trabeum*			
A. mangium				
U.Sedili	0	0	40	60
Kemasul	0	0	100	0
Pinus spp.	0	0	12.5	87.5
	Decay by *C. versicolor*			
A. mangium				
U.Sedili	0	0	100	0
Kemasul	0	30	70	0
L. styraciflua	0	0	0	100

Discussion

In Kemasul, *A. mangium* grows very well on imperfectly drained sites of Durian and Batu Anam soil series (Amir Husni 1983). In Ulu Sedili, the soil is of Serdang series which has low fertility status and moisture retention capability. More fertilizer dosage has to be applied in order to achieve good performance and yield (Paramanathan 1978). This factor and the age difference might be able to explain the difference in the resistance class of the wood of *A. mangium* from both sites.

It is obvious that untreated *A. mangium* should not be used in or near the ground or elsewhere where moisture conditions would be favourable to decay. It is important to recognize that construction techniques which utilize more decay resistant woods may need to be altered if untreated *A. mangium* is used as a replacement. Very little work has been done on the decay fungi in the tropics and many wood decay fungi in Malaysia have not been adequately studied.

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