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ATTACK BY WOOD-DESTROYING INSECTS ON EIGHT COMMERCIAL TIMBER SPECIES

N. Shilpa De Silva and H.S. Amarasekara
Department of Forestry and Environmental Science,
University of Sri Jayewardenepura

Abstract

The relative susceptibility of the heartwood of eight species was studied by exposing them to a subterranean termite, the powder-post beetle, and the longhorn beetle. Both graveyard tests and laboratory methods were used. Observations were made on the weight loss of the timber and on the mortality of the insects. The data were subjected to analysis of variance, and means significantly different at the 5% level were separated by Tukey's test. Finally, the timber species were ranked for resistance to insect attack. The most resistance species were Eucalyptua grandis, teak and jak, followed by Pinus caribaea, lunumidella and mahogany. Rubber was the most susceptible species. Tualang timber was unplaced in the overall ranking, because it was omitted from one test, but it would come near the top.

Introduction

As Sri Lanka is a tropical country, loss of wood due to insect attack is relatively high. A subterranean termite, *Odontotermes redemanni*, the powder-post beetle, *Heterobostrychus brunneus*, and the longhorn beetle, *Batocera rubus*, are known to be major wood destroying insects here (De Silva and Amarasekara, 1996). Of these three insects, the termite is an important pest and it is difficult to find timber species completely immune to its attack. It works inside the timber along the grain, eating out large galleries or runways. The powder-post beetle is also an active and destructive pest; it attacks logs, sawn timber, furniture and buildings. The larvae of the longhorn beetle do serious damage by tunnelling in the heartwood of logs after felling; it is a serious pest in the Moratuwa area. This paper records an attempt to study the attack of these three insects, and to rank the timber species tested according to loss of weight when attacked.

Materials and methods

Insects of the three species mentioned above were collected from infected timber in the Moratuwa area. Specimens of eight commercial timber species: jak (*Artocarpus heterophyllus*), eucalypt (*Eucalyptus grandis*), rubber (*Hevea brasiliensis*), tualang (*Koompassia excelsa*), lunumidella (*Melia dubia*), pine (*Pinus caribaea*), mahogany

(*Swietenia macrophylla*), and teak (*Tectona grandis*) were collected from timber stores and log yards in the same area and used throughout the experiments.

Attack by subterranean termites in the field

Graveyard tests were carried out at the field centre of the University of Sri Jayewardenepura and in a home garden in Udammita in the wet zone, for a period of six months. The plot size was 8 × 3.5 feet (2.44 × 1.07 m). One foot depth (30 cm) of soil was removed and replaced by mould from termites (of the same species), tamped down firmly. Stakes of 50 × 5 × 2.5 cm, of the heartwood of each species, were oven dried at 105°C and put in position (Figure 1). The site was watered in the early stages to help in the formation of colonies (Eaton and Hale, 1993; Gay et al 1957). The percentage weight losses were recorded as:

$$\text{Percent weight loss} = [(W_1 - W_2)/ W_d] \times 100$$

Where:

W_1 = initial weight of the stake
W_2 = weight after attack
W_d = oven-dried weight

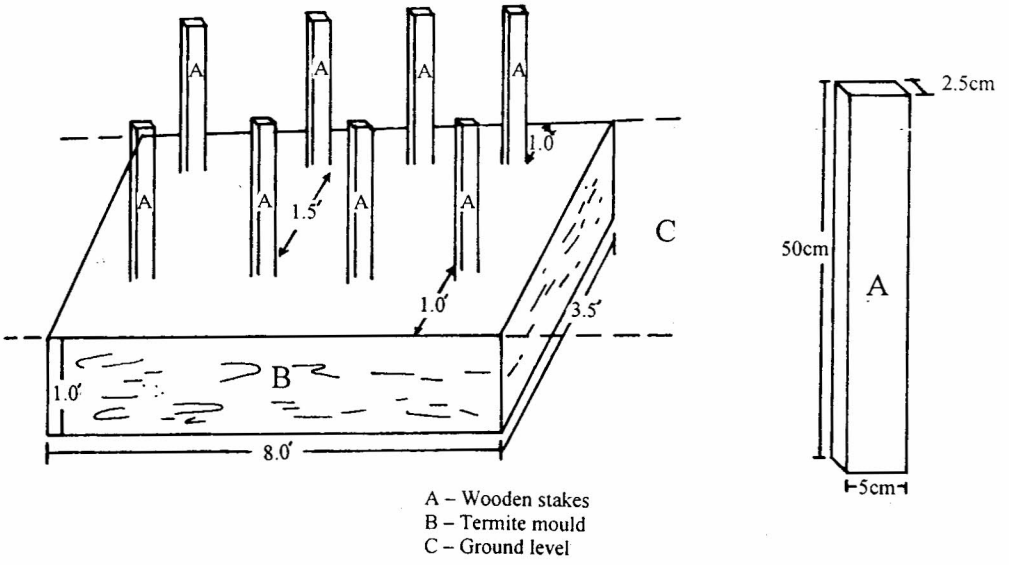
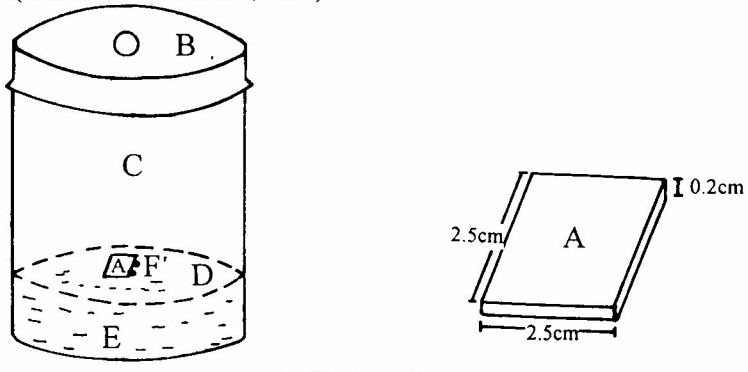


Figure 1: Grave yard Field test for testing subterranean termites

Attack by subterranean termites in the laboratory

Jars of 250 ml capacity were used. Each jar jar contained 75g of soil and 15 ml of distilled water. Wooden wafers 2.5 x 2.5 x 0.2 cm, of heartwood each test species, were placed on the soil. The jars were sealed with cotton plugs and aluminium foil and sterilized in the autoclave. Then 180 workers and 20 soldiers were put into each jar, under aseptic conditions (Figure 2). The weight loss of the wafers acording to the above equation was recorded after one month (Grace and Yamamoto, 1994)



A – Wooden wafers
B - Aluminium foil with cotton plug
C - 250ml test jar
D - 180 worker + 20 soldier
E - 75g. soil + 15ml distilled water
F - Glass ring

Figure 2: Test jar apparatus used in the study of attack of subterranean termites in the laboratory

Attack of powder-post beetle

A similar technique was used for the powder-post beetle, except that instead of wafers, wooden cubes of heartwood, 2.5 x 2.5 x 2.5 cm, were used. The jars were bigger, 500 ml, and instead of soil, each contained 75 g of sawdust from the same timber species as the cube. Ten beetles were placed in each jar (Figure 3). Weight losses were recorded as for the termites (Eaton and Hale, 1993).

Attack of longhorn beetle

Freshly cut short logs, two samples from each species, 30 cm in diameter and 30 cm in length, were used for this test. Tualang was not included, as no fresh logs were available. The test pieces were soaked in water for a week. Three holes (1.5 cm in diameter and 7.5 cm in length) were drilled into each of them, one from bark to pith, one through the sapwood, and one into the heartwood (Figure 4). The logs were kept wet by covering them with constantly wetted filter paper. Longhorn beetle larvae (about 7.5 cm in length) were put in the holes, and left for one month. The weight losses were recorded.

For all the experiments, observations were made on the mortality of the insects. The data on weight loss and mortality were analysed by ANOVA and Tukey's multiple comparison test.

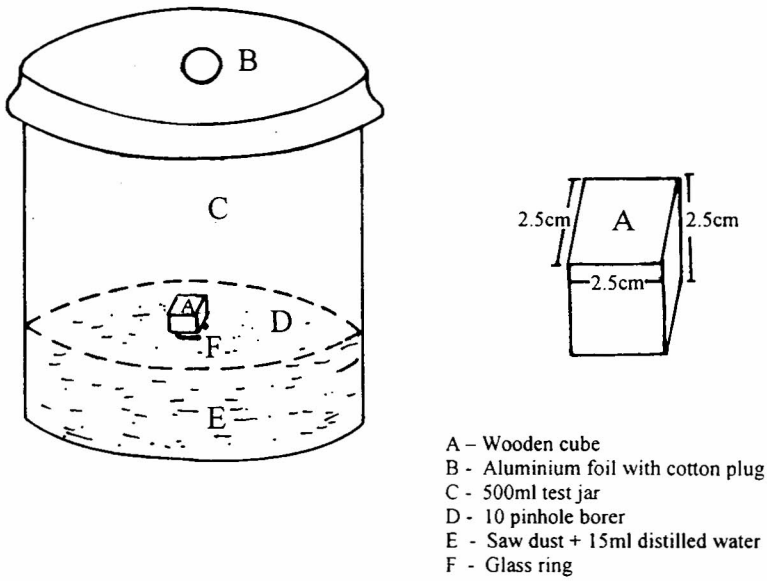


Figure 3: Test jar apparatus used in the study of attack of powder - post beetles

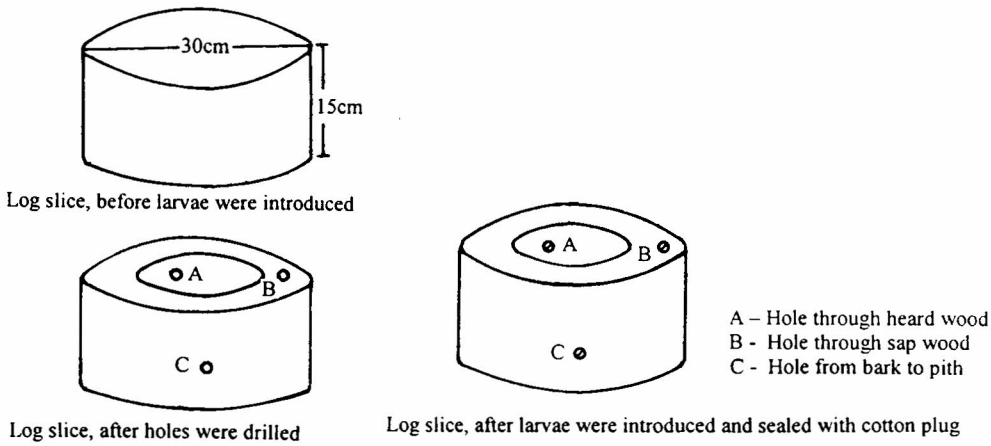


Figure 4: Log slices in which Longhorn Beetles (Betocera) larvae were introduce

Results and discussion

In the graveyard test, the greatest weight loss was observed in rubber, and the second greatest in pine, indicating non-durability when exposed to subterranean termites (Table 1). The weight loss in teak was negligible, confirming its high natural durability. In the laboratory test, termites fed on all species, but the weight losses were small (< 10%) for jak, tualang, teak, and eucalypts. Rubber was highly susceptible to termite attack in the laboratoty, as in the graveyard test (Table 2).

Table 1: Results of graveyard test

Species	Site 1 % Wt. loss Mean ± SD	Site 2 % Wt. loss Mean ± SD
teak	0.025 ± 0.035	0
eucalypt	0.530 ± 0.085	0.140 ± 0.113
tualang	0.580 ± 0.721	0.260 ± 0.269
jak	0.625 ± 0.148	0.460 ± 0.651
lunumidilla	5.150 ± 0.552	1.560 ± 1.273
mahogany	10.585 ± 3.345	20.750 ± 10.960
pine	29.545 ± 0.771	21.840 ± 3.196
rubber	35.695 ± 4.151	32.760 ± 4.794

Table 2 : Laboratory test for subterranean termites

Species	% Wt. loss Mean ± SD	% Mortality Mean ± SD
jak	3.800 ± 0.509	21.5 ± 2.12
tualang	4.880 ± 1.669	21.0 ± 1.41
teak	7.015 ± 0.177	18.0 ± 1.41
eucalypt	9.405 ± 1.987	15.5 ± 0.71
pine	10.815 ± 3.981	13.5 ± 2.12
lunumidilla	13.805 ± 0.672	12.0 ± 1.41
mahogany	15.390 ± 0.552	10.5 ± 0.71
rubber	24.260 ± 1.047	6.0 ± 1.41

Results for the powder-post beetle were different from those for termites. It did not feed on tualang, eucalypts, jak, or teak. Also, on these species, no insects survived (Table 3). mahogany, on the other hand, was highly susceptible to powder-post beetle, and all the insects survived on this species. Higher susceptibility of mahogany has been attributed to high starch content (Hoshim and Hussein, 1981).

For the longhorn beetle, the greatest weight loss was observed in jak (Table 4). Pine, eucalypt, mahogany, and rubber were only lightly attacked. All the introduced larvae died on all these wood species. Teak was only moderately attacked.

Table 3 : Laboratory test for powder-post beetle

Species	% Wt. loss Mean ± SD	% Mortality Mean ± SD
tualang	0	100
eucalypt	0	100
jak	0	100
teak	0	100
rubber	13.160 ± 0.240	10.0 ± 0.0
lunumidilla	15.830 ± 0.849	0
pine	15.900 ± 0.651	5.0 ± 7.07
mahogany	40.090 ± 0.127	0

Table 4 : Laboratory test for longhorn beetle

Species	% Wt. loss Mean ± SD	% Mortality Mean ± SD
tualang	–b	–
pines	0.600 ± 0.014	100
eucalypt	0.940 ± 0.000	100
mahogany	0.940 ± 0.014	100
rubber	1.210 ± 0.509	100
teak	1.745 ± 0.106	83.5 ± 23.3
lunumidilla	6.655 ± 0.021	0
jak	7.980 ± 0.028	0

Table 5 : Relative resistance (durability) rating in different tests

	Graveyard	Termites in lab.	Powder-post beetle in lab.	Longhorn beetle in lab.	Total	Overall rating
teak	1	3	1	5	10	2
jak	4	1	1	7	13	3
tualang	3	2	1	-	-	-
eucalypt	2	4	1	2	09	1
mahogany	6	7	8	3	24	6
lunumidella	5	6	6	6	23	5
pine	7	5	7	1	20	4
rubber	8	8	5	4	25	7

Conclusions and recommendations

The timbers were ranked according to their resistance to attack (Table 5). Eucalypt was ranked number one, followed by teak and jak. Durability rating for teak has become less than eucalyptus because teak was more susceptible to longhorn beetle attack. Eucalypt, teak and jak were the most resistance species to insect attack (Table 5). These three are recommended for use in construction, exterior joinery, and furniture. Resistance of pine, lunumiddella, and mahogany was lower than those three species. Rubber was ranked as number seven. It is recommended for use only after preservative treatment.

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