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RESEARCH NOTE

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**A Laboratory Evaluation
of Nine Materials for Use
in Ground-Line Maintenance
of Transmission Poles
against Termite Attack.**

by

R. H. Eldridge

Issued under the authority of
Lin Gordon, M.L.A.,
Minister for Conservation and
Water Resources, New South Wales.

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FORESTRY COMMISSION OF N.S.W. SYDNEY, 1976

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TERMITE CONTROL MEASURES

A Laboratory Evaluation of Nine Materials
for Use in Ground-line Maintenance of
Transmission Poles against Termite Attack

by
R. H. Eldridge

SUMMARY

Tests using standard laboratory colonies of *Coptotermes lacteus* (Froggatt) and *Nasutitermes exitiosus* (Hill) were made on samples of *Eucalyptus regnans* which had been dipped in various preservatives.

A protective oil emulsion paste containing 5 per cent pentachlorophenol and 1 per cent heptachlor was the most effective treatment in the laboratory situation, while, as dip treatments, preservatives containing 1 per cent chlordane were also satisfactory.

The only preservative, other than those containing an insecticide, to improve the performance of the test samples against *C. lacteus* was high temperature creosote. Koppers K.C. 900, although not effective against *C. lacteus*, did improve the performance of test samples against *N. exitiosus*.

The addition of tar to two of the preservatives significantly reduced their performance against *C. lacteus*.

INTRODUCTION

This series of tests was initiated after discussion with officers of the Sydney County Council regarding the effectiveness of creosote as a barrier to termite attack when used as a surface coating and "puddled" around the base of transmission poles in service. Some doubt as to the value of creosote, used in this manner, was raised.

Instances of termites building galleries through creosote treated soil, over creosote treated poles and actually penetrating the pole through the creosote barrier have been recorded during an intensive survey of termite attack in transmission poles. There was an obvious need for close examination of current methods of in service maintenance and possible alternative measures.

Da Costa *et al* (1971) demonstrated that creosote acted as a deterrent, in that it discouraged termites from eating treated wood, rather than a repellent which has the connotation of keeping the insects away from the wood. Creosotes did not have any toxic effect on termites.

In tests performed to determine the relative effectiveness of high temperature (H.T.) and low temperature (L.T.) creosotes as timber preservatives against termite attack it was found that high temperature creosotes were superior at low levels of retention (Bezemer *et al.*, 1974). Once again it was clearly demonstrated that neither high temperature nor low temperature creosotes were in any way toxic to the test insects, *Coptotermes acinaciformis acinaciformis* (Froggatt) and *N. exitiosus* (Hill). It should be noted that these tests were performed on pressure treated materials, and it was shown that timber treated with creosote in this way was very resistant to termite attack.

MATERIALS AND METHOD

The test method used was as outlined by Gay *et al.* (1955). A brief description of the method is given below.

Testing is based on the use of standard eating units of termites which enable the effects of timber treatments to be assessed quantitatively under controlled conditions. The standard eating unit is specific for any particular test termite, but can be described in general terms.

The unit is contained within a 1 kg glass jar with a ventilated lid. Within the jar there is a standard quantity, dry weight, of crushed inner-wall mound material and a specific quantity of moisture (e.g., for *C. lacteus*; 90 ml moisture in 120 g mound material). The moist mound material acts as a matrix with which the termites can work and build their nest structure, and as a source of water. At the beginning of the test period the weighed test samples are partially buried in the mound material and 25 g of termites are added to each jar to make up the standard unit, or colony. Approximate equivalent to 25 g of termites is 5 000 to 6 000 workers and soldiers.

The initial population is estimated from untreated control colonies which are dismantled after 2 days. This allows for handling mortalities resulting from the separation of termites from the mound and the experimental set up.

Two sets of controls are maintained for the experimental period and these are referred to as fed and unfed controls. The fed controls contain untreated test samples and are used to determine the effectiveness of the various treatments. Unfed controls are supplied with no food source other than the mound material matrix, and by comparing population survival time of the treated colonies with the unfed and fed controls some estimation of the toxicity of the treatments can be made.

Nine preservatives were supplied, the details of which are shown in table 1. *E. regnans* was used as the test timber. The method of application, with the exception of protective paste, was to dip each of the test samples into the preservative and place these on racks to dry. The paste, because of its nature, was applied as a thin film over the surface of the test sample.

After treatment the test samples, on their drying racks, were left for 4 weeks in a well-ventilated room before being installed in a constant environment room at 26° C and 71 per cent relative humidity. The test samples were weighed finally on the day prior to the test commencement, giving them a minimum of 11 days to come to an equilibrium moisture content.

TABLE 1
Treatment schedule

Treatment	Preservative	Source
A	H.T. Creosote	WT and FRD Preservation Chemistry.
B	H.T. Creosote + 1 per cent Chlordane	WT and FRD Preservation Chemistry.
C	H.T. Creosote + Tar ¹	Sydney County Council.
D	5 per cent Pentachlorophenol in Diesel Oil.	WT and FRD Preservation Chemistry.
E	Koppers H.D. Timber Protective Paste ²	WT and FRD Preservation Chemistry.
F	K. 55 Creosote	Sydney County Council.
G	H.T. Creosote + Tar + 1 per cent Chlordane.	Sydney County Council.
H	Koppers K.C. 700 ³	Sydney County Council.
J	Koppers K.C. 900 ⁴	Sydney County Council.
X	Untreated Control	
U	Unfed Control	

¹ High Temperature Creosote + Tar as used by Sydney County Council.

² Oil emulsion paste + 5 per cent pentachlorophenol + 1 per cent heptachlor.

³ Coal tar solution type I.

⁴ Coal tar solution type II.

Two species of termites, *C. lacteus* (Froggatt) and *N. exitiosus* (Hill), were selected as the test insects. *C. lacteus*, although unrecorded within the Sydney metropolitan area, has been shown to be a good indicator of the possible effects of *C. acinaciformis*, which is by far the most destructive termite in New South Wales.

Five replicates for each treatment were tested along with fed and unfed controls. Part I (test insect, *C. lacteus*) was commenced on 13th June, 1973 and part II (test insect, *N. exitiosus*) was commenced on 25th July, 1973. In part I, mound material of *C. acinaciformis* was used as a matrix.

The parameters examined at the end of the 84-day test period were percentage survival of initial population, percentage of wood eaten (by weight) and percentage of the surface area of the test blocks attacked.

Population survival time was also considered for part II (*N. exitiosus*).

To facilitate analysis of results it was necessary to perform a transformation, $\log_e(x)$, on all data. Analysis of variance was made for each parameter and correlation between these was also considered.

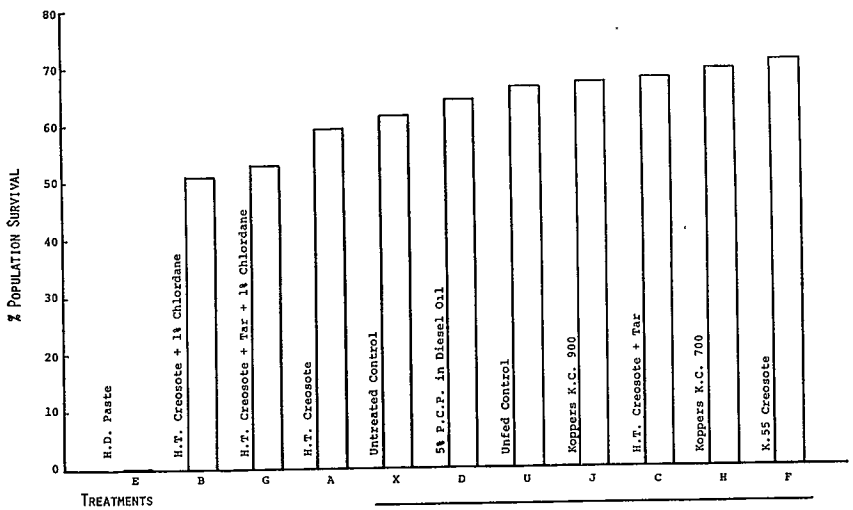
RESULTS—PART I—*COPTOTERMES LACTEUS*

All data resulting from part I are summarized in appendix I. In this summary, values of percentage wood eaten, population survival time and percentage survival after 84 days are given for each treatment replicate.

The results of the analysis of variance are shown in appendix II. For each of the three parameters there was no significant difference between replicates and there were highly significant differences between the different treatments.

Population survival for treatment E (H.D. paste) was zero. The only other colonies to show a reduced population survival, significantly lower than the unfed control colonies were those containing treatments B (H.T. creosote + 1 per cent chlordane) and G (H.T. creosote + tar + 1 per cent chlordane), (fig. 1).

Treatments H (Koppers K.C. 700) and F (K.55 creosote) had a population survival significantly higher than treatments E, B, G and treatment A (H.T. creosote). Apart from the latter no other treatments produced results significantly lower than the fed and unfed controls, (fig. 1).

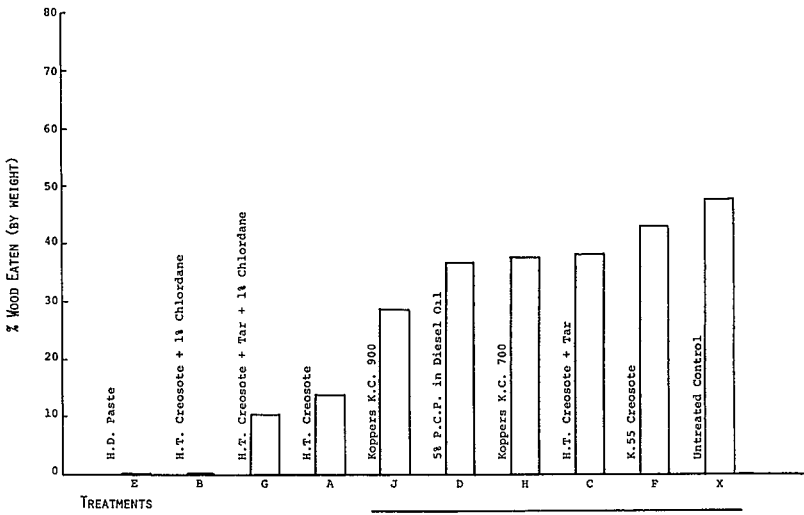


(1) Any two means not underscored by the same line are significantly different. (1% significance level).

Figure 1 Mean per cent population survival after 84 days, *Coptotermes lacteus*

The amount of wood eaten was nil for treatments E (H.D. paste) and B (H.T. creosote + 1 per cent chlordane). This was significantly lower than for treatments G (H.T. creosote + tar + 1 per cent chlordane) and A (H.T. creosote) which were in turn better performers than the untreated controls and all other treatments (fig. 2). There was no significant difference in the amount of wood eaten for treatments J, D, H, C and F either between treatments or when compared with the untreated control colonies (fig. 2).

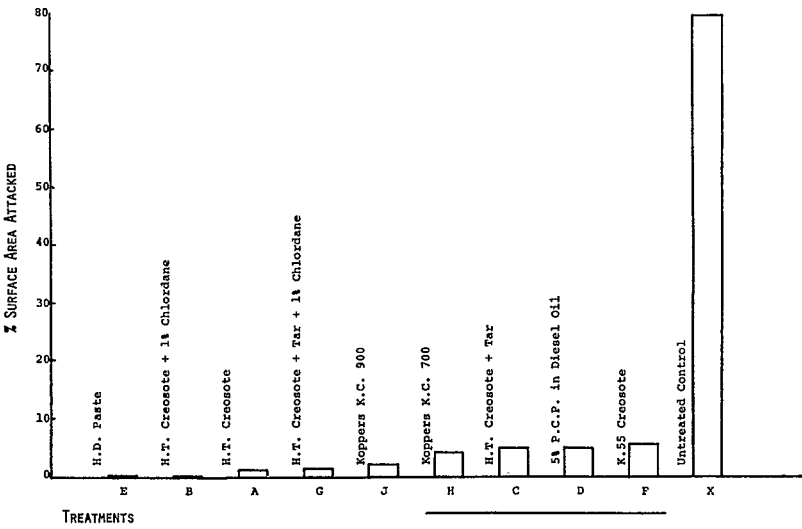
The mean surface area attacked for the untreated control colonies was approximately 80 per cent. There was no surface attack on treatments E or B (fig. 3). This was significantly less than for treatments A, G and J which were comparable in their performance for this parameter. Of these treatments J (Koppers K.C. 900) and H (Koppers K.C. 700) were not significantly different to each other. The remaining treatments



(1) Any two means not underscored by the same line are significantly different (1% significance level).

Figure 2 Mean per cent wood eaten (by weight) after 84 days, *Coptotermes lacteus*

C (H.T. creosote + tar), D (5 per cent P.C.P. in diesel oil) and F (K.55) although not appearing to be as effective as the treatments already mentioned still had much less surface attack than the untreated controls (fig. 3).



(1) Any two means not underscored by the same line are significantly different. (1% significance level).

Figure 3 Mean per cent surface area attacked after 84 days, *Coptotermes lacteus*

The addition of tar significantly increased the surface area attacked for both B (H.T. creosote + 1 per cent chlordane) and A (H.T. creosote), when compared with treatments G and C respectively (fig. 3).

The correlation between the three parameters was examined and it was found that there was very significant correlation between population survival and amount of wood eaten (table 2) and also between amount of wood eaten and surface area attacked. No correlation between population survival and surface area attacked was found.

TABLE 2

Correlation between the three parameters of attack for *Coptotermes lacteus*

Factors	d.f.	r value
Per cent population survival and per cent wood eaten . .	48	.68*
Per cent population survival and per cent surface area attacked.	48	.13 N.S.
Per cent wood eaten and per cent surface area attacked	48	.48*

*—significant at 1 per cent level.

N.S.—not significant.

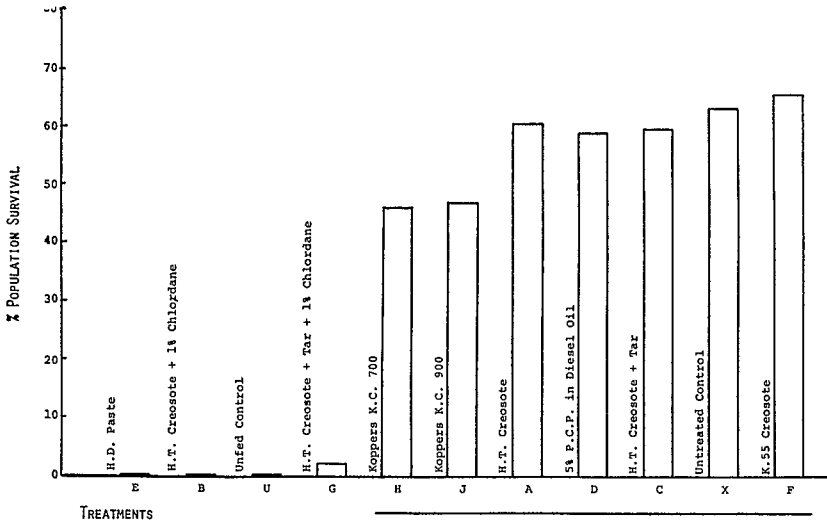
RESULTS—PART II—*NASUTITERMES EXITIOSUS*

All data resulting from part II are summarized in appendix III. This summary contains the same type of data as for part I.

The results of the analysis of variance are shown in appendix IV. As for part I there was no significant difference between replicates and there were highly significant differences between the various treatments.

No unfed control colonies of *Nasutitermes exitiosus* survived the full 84-day test period (fig. 4) but, from the analysis based on the 84-day period being the maximum survival time for any colony, the survival time for these colonies was not significantly different to that of the fed control colonies (fig. 5).

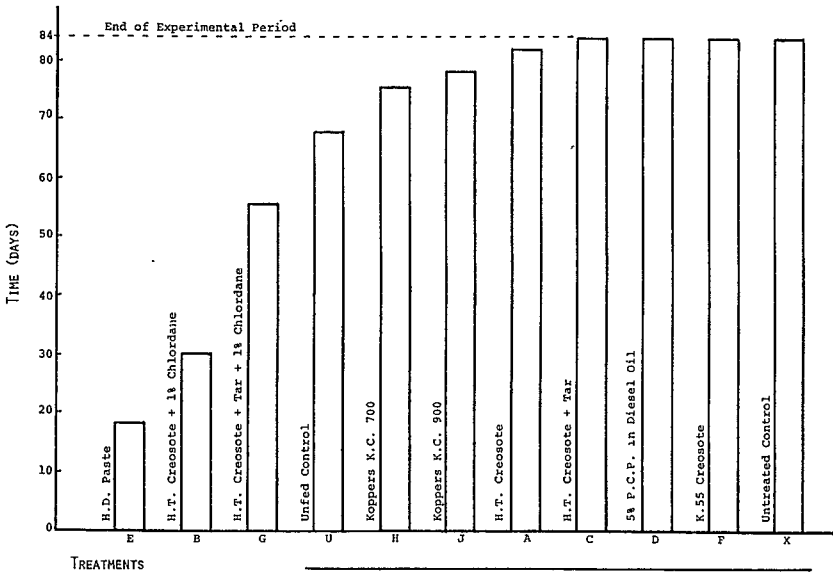
Treatments E (H.D. paste) and B (H.T. creosote + 1 per cent chlordane) were the only sets of colonies to die out completely before the end of the test period (fig. 4). One colony only containing treatment G (H.T. creosote + tar + 1 per cent chlordane) survived until the end of the 84 days, having 10 per cent of its initial population still living. The population survival and survival time of treatment G was not significantly different to that of the unfed control colonies.



(1) Any two means not underscored by the same line are significantly different (1% significance level)

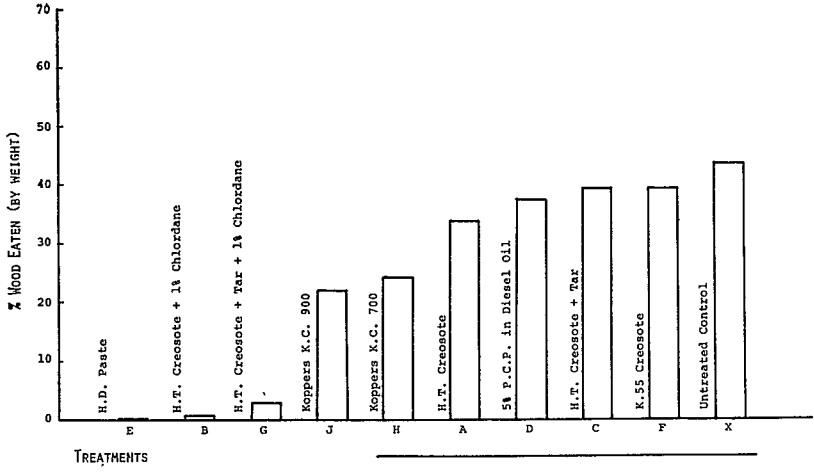
Figure 4 Mean per cent population survival after 84 days, *Nasutitermes exitiosus*

The population survival and survival times for the remaining treatments were not significantly different to those of the fed control colonies (figs 4 and 5).



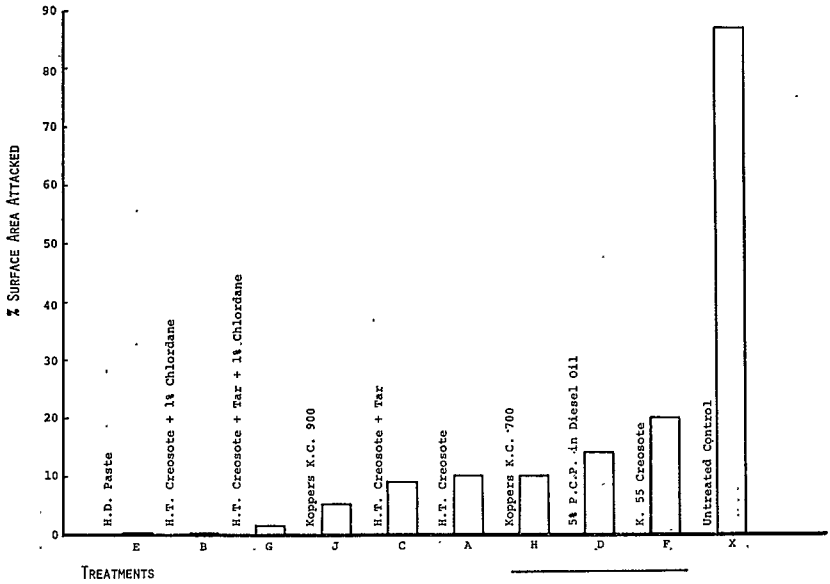
(1) Any two means not underscored by the same line are significantly different (1% Significance level).

Figure 5 Mean population survival time for *Nasutitermes exitiosus*



(1) Any two means not underscored by the same line are significantly different (1% significance level).

Figure 6 Mean per cent wood eaten (by weight) after 84 days, *Nasutitermes exitiosus*



(1) Any two means not underscored by the same line are significantly different (1% significance level).

Figure 7 Mean per cent surface area attacked after 84 days, *Nasutitermes exitiosus*

Treatments E (H.D. paste), B (H.T. Creosote + 1 per cent chlordane), G (H.T. Creosote + tar + 1 per cent chlordane) and J (Koppers K.C. 900) were the only treatments to have significantly less wood eaten than the untreated control colonies (fig. 6). The effect of treatment J was found to be not significantly different from that of H (Koppers K.C. 700) or A (H.T. creosote). Both treatments containing 1 per cent chlordane (B and G) had some wood eaten before the colonies died. No wood was eaten in colonies containing wood treated with H.D. paste (fig. 6).

The mean percentage surface area attacked for the untreated controls was approximately 90 per cent (fig. 7), and the highest percentage surface area attacked for the treated timbers were for treatments F (K.55 creosote), D (5 per cent P.C.P. in diesel oil) and H (Koppers K.C. 700), (fig. 7). Of these the only treatment to show significantly higher surface area attacked than all the remaining treatments was F (fig. 7).

There was very little to separate any of the treatments on the basis of surface area attacked, except for those treatments containing insecticides, E, B and G (fig. 7).

Examination of the correlation between the three parameters of attack revealed very good correlations between all factors. For this species of termite there was a significant correlation between population survival and surface area eaten (table 3). This was not the case for *Coptotermes lacteus* (table 2).

TABLE 3

Correlation between the three parameters of attack for *Nasutitermes exitiosus*

Factors	d.f.	r value
Per cent population survival and per cent wood eaten . .	48	.96*
Per cent population survival and per cent surface area attacked.	48	.51*
Per cent wood eaten and per cent surface area attacked	48	.59*

*—significant at 1 per cent level.

DISCUSSION

The most noticeable result from this bioassay was the extremely good performance of timber treated with H.D. paste. Caution should be exercised in the interpretation of this result in particular. Even after a 4-week period of drying only a thin "crust" had formed on the surface of the gel, and at the time of installation in the test colonies there was considerable free fluid on the surface of the test samples. It is quite feasible that the termite populations were affected by vapours within the test jar diffusing into the mound material matrix.

No treatments other than H.D. paste and those containing 1 per cent chlordane showed any toxic action on either species of test insect. The effect of the treatments containing chlordane was most marked for *N. exitiosus* where most colonies died well before the end of the 84-day test period. It is interesting to note that the effect of the chlordane containing treatments on *C. lacteus* was much slower and the treatment seemed to have a repellent action on the termites as much as a toxic effect. The repellent action was evident in the way *C. lacteus* attempted to isolate the treated timber from the colony by "plastering" all surfaces within a few days of installation.

The addition of tar to the H.T. creosote/chlordane treatment significantly increased the survival time for the colonies of *N. exitiosus* exposed to timber dipped in this treatment.

The lack of toxic action of the various creosotes examined in this test and the free movement of the test insects over the surface of timber treated with these is in good agreement with the work of Da Costa *et al* (1971) and Bezemer *et al* (1974) in which they conclude that creosote acts as a deterrent rather than a repellent. The addition of 1 per cent chlordane appears to increase the effectiveness of these materials when used in this manner, but this test has not shown that creosote is a necessary medium for application of this insecticide.

This test has revealed that, used as surface coatings, H.T. creosote + tar, 5 per cent P.C.P. in diesel oil, K.55 creosote and Koppers K.C. 700 do not significantly increase the resistance of timber to attack by either *C. lacteus* or *N. exitiosus*. Koppers K.C. 900 gave some increased protection against *N. exitiosus* but was not effective against *C. lacteus*.

The performance of high temperature creosote as a deterrent to attack by *C. lacteus*, considering the very thin protective barrier, was quite outstanding. Apart from those containing proven insecticides no other treatment gave the same increased protection against this species of termite as did high temperature creosote. This treatment was not as effective against *N. exitiosus*, but it should be noted that this species does not present anywhere near the hazard of the genus *Coptotermes*.

A very notable feature of the results was the effect of the addition of tar to H.T. creosote and H.T. creosote + 1 per cent chlordane. In both cases the effectiveness of these treatments was significantly reduced, against *C. lacteus*. It is possible that the patches of tar which seemed to adhere to the surface of the timber offer no resistance to termite attack and thus act as a "doorway" through the treatment barrier, to the untreated timber beneath.

An examination of surface area eaten shows that all treatments had some deterrent effect on termites eating wood in direct contact with the preservative. Once the surface barrier was broken the following attack was concentrated at that point. This was particularly evident with *C. lacteus* which gave no correlation between surface area attacked and population survival. On the other hand the results for *N. exitiosus* indicate that the population survival was closely related to the surface area attacked. This is in good agreement with what is already known about the mode of attack of members of these two genera. *Coptotermes* tend to destroy a piece of timber working from the inside to the outside surface, usually leaving a thin shell of timber on the outside.

Nasutitermes tend to "abrade" a piece of timber, working from the outside, inwards.

These results emphasize the point that if a barrier treatment of any kind is to be completely effective against termite attack it must have no points of weakness at all. This point may be extended to include pressure impregnated timber, particularly poles and posts where the treated sapwood and end grain represents a physical, protective barrier covering the untreated heartwood.

The overall results point to some flaws in the experimental method. *Coptotermes lacteus* colonies installed with *Coptotermes* mound material as a base medium can easily survive the full 84-day test period without any other additional food source. This reduces the effectiveness of this method as a forced feeding test, as the insects are not under any food stress at any time during the course of the experiment.

The rather dramatic effect of H.D. paste in the confines of the experimental colony container points to the possible need of some type of accelerated weathering of the treated timber before installation in the test colony. This may also give a better indication of the long term effectiveness of any particular treatment.

The results of this bioassay give only an indication of how the test materials may perform in the field and are not by any means an absolute statement of the effectiveness of the test materials.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the considerable amount of work contributed to this project by Dr Judith L. Reynolds. The bioassay was initially planned by Dr Reynolds in conjunction with the Sydney County Council and the work carried out by Dr Reynolds and the author. Dr Reynolds was forced to resign, due to ill health, before the results of this work could be reported.

The statistical analysis of the results was performed by N. Omar. His advice and assistance during the course of this bioassay is greatly appreciated.

The author would also like to thank the Sydney County Council for its ready co-operation, and supply of test materials.

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APPENDIX

Summary of results for part I (*Coptotermes lacteus*)

Colony	Treatment	Amount eaten		Population survival	
		Weight per cent	Surface area per cent	Time (days)	Per cent of initial population
U1	Unfed .. .. .	..	..	84	67.9
U2		..	..	84	61.5
U3		..	..	84	69.4
U4		..	..	84	66.3
U5		..	..	84	66.2
Mean		..	..	84	66.26
X2	Untreated	51.0	87.5	84	57.2
X3		53.1	78.3	84	63.5
X4		38.7	73.3	84	56.1
X5		56.8	75.3	84	67.4
X6		38.9	84.2	84	62.5
Mean		47.7	79.72	84	61.34
A1	High temperature creosote ..	5.8	0.2	84	58.4
A2		11.7	0.3	84	60.8
A3		17.2	1.8	84	54.2
A4		16.3	0.9	84	59.1
A5		19.5	1.2	84	61.9
Mean		14.1	0.88	84	58.88
B1	High temperature Creosote + 1 per cent chlordane.	0	0	84	47.8
B2		0	0	84	48.1
B3		0	0	84	52.8
B4		0	0	84	49.9
B5		0	0	84	55.9
Mean		0	0	84	50.9
C1	High temperature Creosote + Tar.	39.3	7.1	84	80.4
C2		38.2	3.7	84	68.5
C3		44.6	2.3	84	61.1
C4		37.8	4.7	84	68.9
C5		30.2	5.0	84	58.6
Mean		38.02	4.56	84	67.5
D1	5 per cent P.C.P. in Diesel Oil	25.3	5.6	84	52.9
D2		34.9	3.8	84	66.8
D3		34.8	6.5	84	57.7
D4		47.6	4.2	84	68.8
D5		41.3	4.1	84	73.2
Mean		36.78	4.84	84	63.88

Colony	Treatment	Amount eaten		Population survival	
		Weight per cent	Surface area per cent	Time (days)	Per cent of initial population
E1	} H.D. Paste }	0	0	13	0
E2		0	0	14	0
E3		0	0	12	0
E4		0	0	14	0
E5		0	0	19	0
Mean		0	0	14.4	0
F1	} K. 55 Creosote }	45.3	4.4	84	73.5
F2		48.9	8.8	84	73.5
F3		42.4	5.1	84	73.2
F4		37.6	4.4	84	62.2
F5		40.2	4.2	84	69.2
Mean		42.88	5.38	84	70.32
G1	} High temperature Creosote + Tar + 1 per cent chloro- dane. }	5.7	0.2	84	50.1
G2		19.5	3.4	84	54.4
G3		22.4	1.7	84	60.4
G4		0.5	0.1	84	48.4
G5		4.8	0.4	84	51.0
Mean		10.58	1.16	84	52.86
H1	} Koppers K.C. 700 }	32.3	3.7	84	65.3
H2		39.0	3.3	84	69.4
H3		40.3	2.9	84	65.8
H4		39.3	2.3	84	72.9
H5		36.7	3.1	84	72.0
Mean		37.52	3.06	84	69.08
J1	} Koppers K.C. 900 }	15.8	1.5	84	67.8
J2		38.3	3.2	84	68.6
J3		32.5	2.2	84	63.9
J4		29.0	1.1	84	70.5
J5		27.6	1.7	84	63.6
Mean		28.64	1.94	84	66.88

APPENDIX II

Analysis of variance table for *Coptotermes lacteus*

Factors	Degrees of freedom	Sum of squares	Mean square	F value
A. Per cent population survival after 84 days				
Treatments	9	.5180	.0576	7.89 *
Replicates	4	.0121	.0030	0.41 N.S.
Error	36	.2629	.0073	..
Total	49	.7930	..	..
Least significant difference (1 per cent) = .146				
B. Per cent wood eaten (by weight) after 84 days				
Treatments	9	102.9943	11.4438	71.79 *
Replicates	4	.8397	.2099	1.32 N.S.
Error	36	5.7371	.1594	..
Total	49	109.571	..	..
Least significant difference (1 per cent) = .682				
C. Per cent surface area eaten after 84 days				
Treatments	9	72.9067	8.1007	102.28 *
Replicates	4	.3206	.0802	1.01 N.S.
Error	36	2.8497	.0792	..
Total	49	76.077	..	..
Least significant difference (1 per cent) = .481				

*—1 per cent level of significance.

N.S.—not significant.

APPENDIX III

Summary of results for part II (*Nasutitermes exitiosus*)

Colony	Treatment	Amount eaten		Population survival	
		Weight per cent	Surface area per cent	Time (days)	Per cent of initial population
U1	} Unfed .. .. . }	..	..	71	0
U2		..	..	77	0
U3		..	..	71	0
U4		..	..	43	0
U5		..	..	81	0
Mean		..	..	68.6	0
X2	} Untreated }	40.4	85.1	84	57.9
X3		44.3	86.9	84	56.2
X4		46.3	86.7	84	65.7
X5		44.3	82.9	84	69.0
X6		42.4	93.4	84	68.5
Mean		43.54	87.0	84	63.46
A1	} High temperature Creosote.. }	31.3	12.5	84	62.1
A2		33.7	6.6	84	59.7
A3		2.9	1.8	76	0
A4		33.6	17.6	84	61.1
A5		37.6	12.0	84	62.3
Mean		27.82	10.1	82.4	49.04
B1	} High temperature Creosote + 1 per cent chlordane. }	0.1	0*	33	0
B2		0	0	30	0
B3		0.1	0	22	0
B4		0.2	0	42	0
B5		0.2	0	33	0
Mean		0.12	0	32	0
C1	} High temperature Creosote + Tar. }	31.6	3.5	84	60.3
C2		43.4	9.5	84	61.0
C3		50.4	14.7	84	78.6
C4		36.7	8.3	84	53.0
C5		36.1	8.9	84	48.1
Mean		39.64	8.98	84	60.2
D1	} 5 per cent P.C.P. in Diesel Oil }	33.5	7.6	84	50.2
D2		38.9	20.4	84	58.7
D3		46.1	15.9	84	64.1
D4		34.5	10.6	84	71.0
D5		35.2	16.4	84	52.4
Mean		37.64	14.18	84	59.28

Colony	Treatment	Amount eaten		Population survival	
		Weight per cent	Surface area per cent	Time (days)	Per cent of initial population
E1	} H.D. Paste }	0	0	19	0
E2		0	0	15	0
E3		0	0	19	0
E4		0	0	19	0
E5		0	0	19	0
Mean		0	0	18.2	0
F1	} K. 55 Creosote }	39.9	19.6	84	59.3
F2		48.1	20.1	84	58.0
F3		33.4	19.6	84	61.2
F4		38.0	18.5	84	72.8
F5		38.0	21.3	84	77.4
Mean		39.48	19.82	84	65.74
G1	} High temperature Creosote + Tar + 1 per cent chlor- dane. }	0.3	0.3	54	0
G2		0.3	0.8	46	0
G3		13.9	5.7	84	9.7
G4		0.4	0.9	46	0
G5		0	0	48	0
Mean		2.98	1.54	55.6	1.94
H1	} Koppers K.C. 700 }	29.7	10.6	84	57.9
H2		25.1	12.1	84	45.9
H3		25.9	14.5	84	57.3
H4		5.8	4.0	42	0
H5		14.6	7.4	84	32.9
Mean		20.22	9.72	75.6	38.8
J1	} Koppers K.C. 900 }	36.7	8.1	84	58.8
J2		28.3	7.5	84	61.1
J3		12.8	4.5	84	35.5
J4		0	1.4	56	0
J5		10.0	4.5	84	32.5
Mean		17.56	5.2	78.4	37.58

*- Slight surface nibbles, negligible area.

APPENDIX IV

Analysis of variance table for *Nasutitermes exitiosus*

Factors	Degrees of freedom	Sum of squares	Mean square	F value
A. Per cent population survival after 84 days				
Treatments	9	142.0545	15.7838	14.78 *
Replicates	4	4.0130	1.0033	0.94 N.S.
Error	36	38.4329	1.0676	..
Total	49	184.5003	..	..
Least significant difference (1 per cent) = 1.764				
B. Per cent wood eaten (by weight) after 84 days				
Treatments	9	107.3128	11.9236	24.90 *
Replicates	4	1.7686	.4421	0.92 N.S.
Error	36	17.2389	.4789	..
Total	49	126.3203	..	..
Least significant difference (1 per cent) = 1.182				
C. Per cent surface area eaten after 84 days				
Treatments	9	88.0983	9.7887	48.63 *
Replicates	4	.4097	.1024	0.51 N.S.
Error	36	7.2455	.2013	..
Total	49	95.7536	..	..
Least significant difference (1 per cent) = .766				
D. Population survival time (days) (no transformation of this data)				
Treatments	10	26 636.539	2 663.654	30.22 *
Replicates	4	724.613	181.153	2.05 N.S.
Error	40	3 526.195	88.155	..
Total	54	30 887.348	..	..
Least significant difference (1 per cent) = 16.03				

*—1 per cent significance level.

N.S.—not significant.

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