# TERMITE MANAGEMENT IN BUILDINGS

Significant progress has been made in the last decade in the area of termite control. Termites are known to render heavy losses to timber, buildings and materials. Lately, several agrochemicals, non-toxic and eco-friendly control measures have been introduced to protect these resources. This book contains the papers presented at the National Workshop on Termite Management in Buildings organized by the Central Building Research Institute, Roorkee, February 20-21, 1995. It includes the latest trends in termite management and valuable research data on termites and information on bio-pesticides and bio-insecticides.

The book will be of immense reference value to a wide range of specialists in the areas including pesticide research, civil engineering, botany and zoology.

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SINGH

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Edited by
Y. SINGH

CENTRAL BUILDING RESEARCH INSTITUTE

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# EFFECTIVENESS OF AGRO-CHEMICALS AS WOOD PRESERVATIVES

**Y. SINGH and B.S. RAWAT**
*Central Building Research Institute, Roorkee-247 667*

Termite control in buildings is achieved by creating poisonous chemical barrier in the soil in and around the foundation. However, it is also desirable to treat the wooden units with some pesticide or preservative solution (1). A survey of literature reveals that not much information is available on the effect of various agrochemicals if they are used for treatment of wood. Therefore, a systematic study was carried out on termite attack on various woods treated with eco-friendly pesticides.

**Insecticides**

Insecticides used for testing purpose were Dichlorvos, Monocrotofos, Malathion, Chlorpyrifos, Endosulfan, Triazophos, Deltamethrin and a Biopesticide. The organic insecticides were commercial products with various trade names. The biopesticide was fermented product of carbohydrates prepared in the Microbiology Division of Regional Research Laboratory, Jorhat.

The pesticides were used for study in various concentrations and diluted in kerosene. Dichlorvos, Monocrotofos, Malathion, Chlorpyrifos, Endosulfan, Triazophos, were used in 1.0%, 0.5% and 0.25% (a/i) concentrations while Deltamethrin was used in 0.25%, 0.1% and 0.01% (a/i) concentrations. However, biopesticide was used in 100% and 50% concentrations.

**Woods**

Strips of the size 2.5 x 2.5 cm were cut from mango (Mangifera indica), Chir (P. roxburghii) and Poplar (Populus Linn.) woods. They were air dried to 10 percent moisture content. Test blocks of lengths 2.5 cm were cut from these strips for testing purposes. All the surfaces of the test blocks were jack planned so as to have uniformly smooth surface. In addition, fine grade sand paper was used to make surface very smooth, so that even slight nibling by termites could be detected. Ten blocks of each wood dipped in the Kerosene solution of each concentration of every pesticide for 24 hrs., so that all the surfaces were dipped freely in the solution. They were taken out and dried at room temperature.



To study the leaching of pesticides from the test blocks, five blocks of each wood treated with various concentrations of different pesticides were subjected to continuous water washing for a period of 4 hrs. These cubes were dried at room temperature before starting the experiment.

**Test Termite**

Termite species used were Microcerotermes beesoni Snyder of which major active workers were sorted out for experimental purpose.

The testing was carried out as per technique adopted by Sen-Sarma et al. (3-5). A brief description of the same are as follows:

**Preparation of Culture Bottles**

Rectangular glass bottles (capacity 1500ml, 20 x 8.5 cm) provided with tin lids were used for these tests. Each bottle was thoroughly washed and dried. It was then filled with 250 gm of air dried soil, moistened with distilled water upto 15-20% moisture content. The soil was collected from the upper parts of mounds of Odontotermes obesus (Rambur), having a uniform texture and $p_H$ ranging from 6.0 -6.7. In the laboratory, lumps of soil were broken up, crushed and made fine by passing through fine sieve. It was then sterlised in an autoclave at 15 pounds pressure for two hours.

Only one test block was put in each bottle. A thin (20 x 20 x 2.5 mm) feeder strip of Mangifera indica, a perishable wood, was kept along with the test block for readily attracting termites to the test block. The test block along with feeder strip was placed fully buried inside the culture medium on the side of the glass bottles, as the test termites exhibit strong thigmotactic reaction. A small empty nest piece, collected earlier from the broken nests, is also placed adjacent to the test block. Then sterlised soil is poured to cover the test block completely and the nest piece partially. Approximately 1000 workers preconditioned at a low relative humidity (5-10%) were then released inside the bottles. The preconditioning in a dry environment induces test termites to enter into the moist culture medium quickly.

**Observations**

It was observed that test termites in the bottle could survive upto four months. Therefore, experiments were carried out for three months only at one instance. After recording the observations the experiments were restarted using the same wooden blocks.

The effect of various pesticides to control termite attack on three woods (without washing) were recorded in Tables 1-4. However, the effect after washing the test blocks were recorded in Tables 5-8.

**Results and Discussion**

From the Tables 1-4 it is evident that the wooden test blocks treated with 1.0% and 0.5% concentration of Dichlorvos and Monocrotofos were not attacked with termites upto nine months. However, treated with 0.25% concentrations of both the pesticides they were attacked after six months. In case of Dichlorovos the attack was very slight, but in case of Monocrotofos it was slight. In case of treatment with Malathion there was no attack of termites on test blocks treated with 1.0 and 0.5% concentration but attack started in test blocks treated with 0.25% concentration within after three months and increased subsequently. However, no attack was observed on either of the test blocks of the three woods treated with, Chlorpyrifos, Endosulfan and Triazophos even upto nine months. In case of Deltamethrin, attack was observed after three months on the test blocks treated with 0.01% concentration. However, it was not increased further. In case of Biopesticide, the test blocks treated with 100% concentration were remained unattacked upto 3 months and then very slight attack was observed. However, with 50% concentration, the attack started after 3 months which increased subsequently.

The effect of various pesticides in termite attack after surface washing with water of test blocks for 4 hrs. is reported in Tables 5-8. It is clear from the results that trends of protection of the test blocks is similar to that of unwashed blocks. However, in case of treatment with Biopesticide, it started attacking after three months even in case of treatment with 100% concentration.

**Conclusions**

From the foregoing results and discussion it can be concluded that:

(I) Chlorpyrifos, Endosulfan, Triazophos are equally effective to control termite attack on all the three type of woods even with 0.25% concentration. It is true even on washed wooden surfaces.

(II) Dichlorvos, Monocrotofos, Malathion and Deltamethrin are quite effective upto 0.5% concentration but in the long term slight termite attack appeared with 0.25% concentration. There was also not any difference in case of washed surfaces.

(III) Biopesticide without washing is quite effective at 100% concentration upto 6 months. However, after washing it could protect upto 3 months.

**Acknowledgement**

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**TABLE - 1**

**Effect of Dichlorvos and Monochrotofos as Preservatives on Mango, Chir and Poplar Woods.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results (MONTH) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Dichlorvos | 1.0 | .333 | 3 | - | .605 | 3 | - | .419 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .355 | 3 | - | .112 | 3 | - | .271 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .456 | 3 | - | .243 | 3 | - | .459 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | * | | 9 | * | | 9 | * |
| 2. Monocrotofos | 1.0 | .174 | 3 | - | .209 | 3 | - | .291 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .483 | 3 | - | .419 | 3 | - | .300 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .105 | 3 | - | .399 | 3 | - | .333 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | ** | | 9 | ** | | 9 | ** |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |

**TABLE - 2**

**Effect of Malathion and Chlorpyrifos as Preservatives on Mango, Chir and Poplar Woods.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Malathion | 1.0 | .540 | 3 | - | .212 | 3 | - | .183 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .241 | 3 | - | .252 | 3 | - | .245 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .209 | 3 | - | .262 | 3 | - | .494 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | 0 | | 9 | 0 | | 9 | 0 |
| 2. Chlorpyrifos | 1.0 | .113 | 3 | - | .172 | 3 | - | .494 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .134 | 3 | - | .322 | 3 | - | .278 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .313 | 3 | - | .271 | 3 | - | .281 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |



**TABLE - 3**

**Effect of Endosulfan and Triazofos as Preservatives on Mango, Chir and Poplar Woods.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1.Endosulfan | 1.0 | .956 | 3 | - | .288 | 3 | - | .373 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .172 | 3 | - | .296 | 3 | - | .294 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .277 | 3 | - | .421 | 3 | - | .314 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| 2.Triazophos | 1.0 | .108 | 3 | - | .281 | 3 | - | .238 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .313 | 3 | - | .499 | 3 | - | .434 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .212 | 3 | - | .407 | 3 | - | .289 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |

**TABLE - 4**

**Effect of Deltamethrin and Biopesticide as Preservatives on Mango, Chir and Poplar Woods.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Deltamethrin | 0.25 | .133 | 3 | - | .288 | 3 | - | .250 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.1 | .076 | 3 | - | .279 | 3 | - | .289 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.01 | .149 | 3 | - | .331 | 3 | - | .321 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | * | | 9 | * | | 9 | * |
| 2. Biopesticide | 100 | .360 | 3 | - | .168 | 3 | - | .240 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | ** | | 9 | ** | | 9 | ** |
| | 50 | .295 | 3 | - | .198 | 3 | - | .270 | 3 | - |
| | | | 6 | ** | | 6 | ** | | 6 | ** |
| | | | 9 | *** | | 9 | 00 | | 9 | 00 |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |



**TABLE - 5**

**Effect of Dichlorvos and Monochrotofos as Preservatives on Mango, Chir and Poplar Woods after Washing.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Dichlorvos | 1.0 | .401 | 3 | - | .378 | 3 | - | .411 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .342 | 3 | - | .359 | 3 | - | .409 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .109 | 3 | - | .081 | 3 | - | .121 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | * | | 9 | * | | 9 | * |
| 2. Monocrotofos | 1.0 | .371 | 3 | - | .305 | 3 | - | .355 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .353 | 3 | - | .375 | 3 | - | .380 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .802 | 3 | - | .811 | 3 | - | .415 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | ** | | 9 | ** | | 9 | ** |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |

**TABLE - 6**

**Effect of Malathion and Chlorpyrifos as Preservatives on Mango, Chir and Poplar Woods after Washing.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Malathion | 1.0 | .228 | 3 | - | .301 | 3 | - | .277 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .102 | 3 | - | .215 | 3 | - | .276 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .258 | 3 | - | .266 | 3 | - | .309 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | 0 | | 9 | 0 | | 9 | 0 |
| 2. Chlorpyrifos | 1.0 | .159 | 3 | - | .166 | 3 | - | .216 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .211 | 3 | - | .198 | 3 | - | .240 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .151 | 3 | - | .176 | 3 | - | .301 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |



**TABLE - 7**

**Effect of Endosulfan and Triazofos as Preservatives on Mango, Chir and Poplar Woods after Washing.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Endosulfan | 1.0 | .933 | 3 | - | .611 | 3 | - | .304 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .164 | 3 | - | .265 | 3 | - | .277 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .415 | 3 | - | .376 | 3 | - | .301 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| 2. Triazophos | 1.0 | .151 | 3 | - | .167 | 3 | - | .188 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.5 | .211 | 3 | - | .175 | 3 | - | .181 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.25 | .158 | 3 | - | .116 | 3 | - | .155 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |

**TABLE - 8**

**Effect of Deltamethrin and Biopesticide as Preservatives on Mango, Chir and Poplar Woods after Washing.**

| Pesticide | dose % | MANGO WOOD | | | CHIR WOOD | | | POPLAR WOOD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results | Loading (MEAN) | Period (MONTH) | Results |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Deltamethrin | 0.25 | .125 | 3 | - | .212 | 3 | - | .177 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.1 | .108 | 3 | - | .236 | 3 | - | .158 | 3 | - |
| | | | 6 | - | | 6 | - | | 6 | - |
| | | | 9 | - | | 9 | - | | 9 | - |
| | 0.01 | .165 | 3 | - | .301 | 3 | - | .212 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | * | | 9 | * | | 9 | * |
| 2. Biopesticide | 100 | .111 | 3 | - | .171 | 3 | | .155 | 3 | - |
| | | | 6 | * | | 6 | * | | 6 | * |
| | | | 9 | ** | | 9 | ** | | 9 | ** |
| | 50 | .123 | 3 | - | .211 | 3 | - | .158 | 3 | - |
| | | | 6 | ** | | 6 | ** | | 6 | ** |
| | | | 9 | *** | | 9 | 00 | | 9 | 00 |

Abbreviations (for nibling)

| | |
|---|---|
| - | Nil |
| * | Very slight |
| ** | Slight |
| *** | Moderate |
| 0 | Heavy |
| 00 | Very Heavy |



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