N - 19

34th year

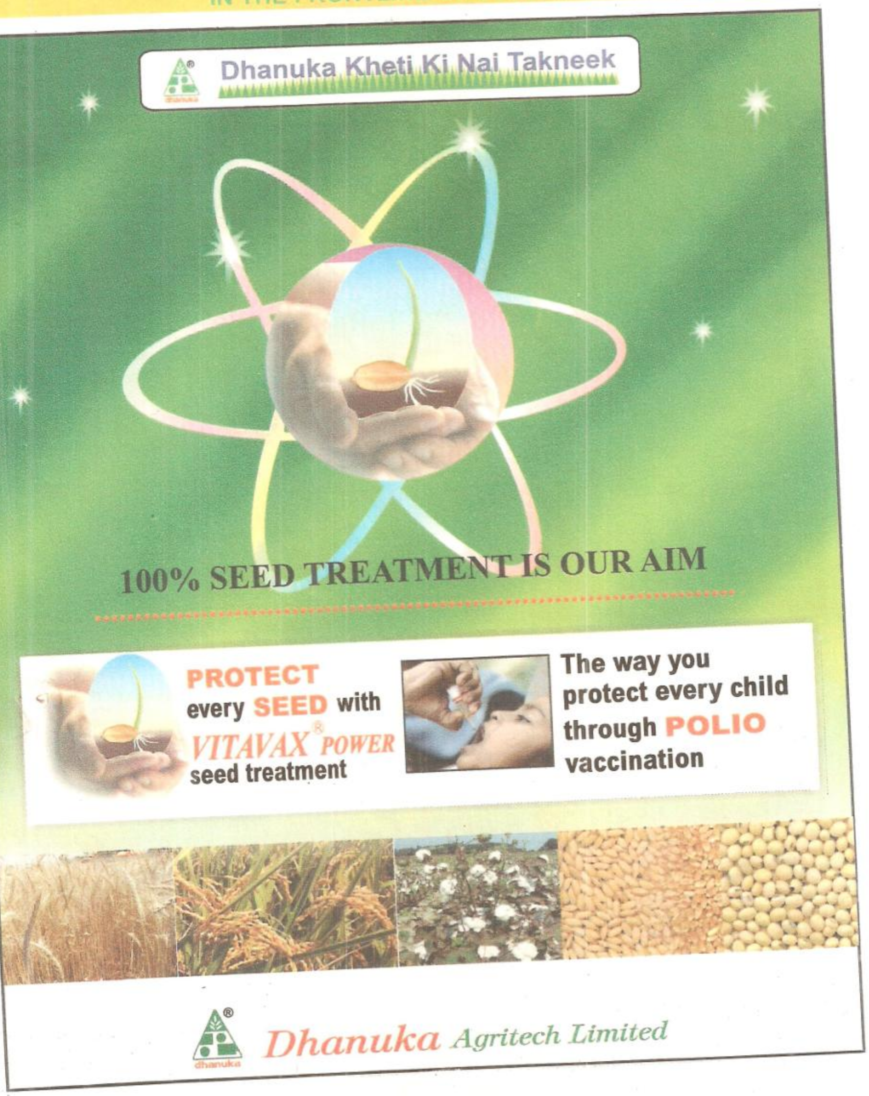
VOL. XXXIII NO. 4 APRIL 2009

ISSN 0970-3012

KEEPING THE WORLD GREEN... HEALTH FOR ALL

PESTOLOGY

IN THE FRONTLINE OF SERVICE TO AGRICULTURE



CYRUX **TERMITES**

SEARCHING OPTIMUM LETHAL DOSE OF CYRUX (CYPERMETHRIN 25 E.C.) FOR TERMITE MANAGEMENT IN BUILDINGS

DR. B. S. RAWAT
Scientist, Central Building Research Institute, Roorkee-247 667, Uttarakhand, INDIA.

ABSTRACT

Termites are by and large serious biodegrading agent affecting all types of buildings throughout the world, therefore considered an important structure damaging pest. They cause damage to millions of buildings each year. Considerable attention has been given in recent years to bio-rational compounds for pest management in buildings. The drive is to move away from highly toxic pesticides and introduce less-toxic products for the same. In search of optimum lethal dose of Cypermethrin 25 E.C. for termite management in buildings, three experiments *viz.* (i) Modified ground board test, (ii) Determination of residual toxicity, and (iii) Anti-termite treatment in termite-infested buildings, were carried out in different climatic and soil conditions in India. On the basis of data analysis of five years experimental period; minimum 0.25% concentration (a/i) and above is found effective for termite management in buildings up to five years.

KEY WORDS: **Termite control, Building, Pest, Cypermethrin, Synthetic pyrethroid, Soil Termiticide.**

Introduction

Termites are most important pests of wooden structures in rural and urban buildings. Residential and commercial building construction practices around the world often bring wood into close or direct contact with the soil, which may result in termite attack. Termite utilizes cellulosic material as a food source. Its 2,761 species are known comprising about 300 genera; mostly tropical or subtropical. More than 350 species are found in India; out of which 110 are timber-infesting. They are found in tropical and warm temperate areas of the world occupying nearly 70% of the land. Some termites are able to colonize colder countries, where people construct centrally heated buildings. Termites are occasionally even found in snow prone areas, such as Thredbo and Perisher Valley. In India, cost of termite damage and control exceeds 5 million dollars annually. Termites have the ability to locate small openings in concrete slabs and foundation walls to enter into buildings. Chlorpyrifos 20 E.C. and Lindane 20 E.C., are registered termiticides in India (IS:6313,Part 3,2001). Unfortunately, both are proved deadlier and stable in the environment in the findings of a Delhi based NGO. Environmental Protection Agency (EPA) also put on restrictions on Dursban (Chlorpyrifos) for its uses in all household purposes. Therefore, there is an urgent need to search non-toxic or less toxic alternative of highly-toxic pesticides for the future. Institute has taken initiative in this direction and evaluated lot of agrochemicals for the same; Cypermethrin 25 E.C. is one of them.

Cypermethrin 25 E.C. is a synthetic pyrethroid based pesticide. Synthetic pyrethroids are often described by pest control operators and community mosquito management bureau as "*Safe as Chrysanthemum flowers.*" While pyrethroids are a synthetic version of an extract from the chrysanthemum plant, they are chemically engineered to be more toxic with longer break down times, and are often formulated with synergistics, increasing potency and compromising the human body's ability to detoxify the pesticide. Chemical name of Cypermethrin is -(R,S)-alpha-cyano-3-phenoxybenzyl(lrs)-cis,trans-3-(2,2-dichlorovinyl)-2,

Table 1

Five year's observations of Modified Ground Board Test of Cypermethrin 25 E.C.

Sl. Nos.	Dose Rate % (a/i)	Sites	Year / Months									
			1 Yr		2 Yr		3 Yr		4 Yr		5 Yr	
			06	12	18	24	30	36	42	48	54	60
1	0.50	R	–	–	–	–	–	–	–	–	–	x
		D	–	–	–	–	–	–	–	–	–	x
		V	–	–	–	–	–	–	–	–	–	xxx
2	0.25	R	–	–	–	–	–	–	x	x	xx	xxx
		D	–	–	–	–	–	–	x	x	xx	xxx
		V	–	–	–	–	–	–	xx	xx	xx	xxx
3	0.125	R	–	–	x	xx	xx	xx	xxx	xxx	***	***
		D	x	x	xx	xx	xx	xxx	***	***	***	***
		V	x	x	xx	xx	xxx	xxx	Xxx	***	***	***
4	0.05	R	xx	xx	xxx	xxx	xxx	xxx	***	***	***	***
		D	xx	xxx	xxx	xxx	xxx	xxx	***	***	***	***
		V	xx	xxx	xxx	xxx	xxx	xxx	***	***	***	***
5	Control	R	x	xxx	***	***	***	***	***	***	***	***
		D	x	xxx	***	***	***	***	***	***	***	***
		V	x	xx	xxx	***	***	***	***	***	***	***

*Abbreviations: R = Roorkee, D = Dehradun, V = Vapi, – = No damage, x = Slight Damage, xx = Damage, xxx = Highly Damaged, *** = Eaten away.*

Table 2

Mortality of termites on soil collected from various depths after five years of experimental period

Sl. No.	Dose Rate % (a/i)	Exptl. Sites	100% Termite mortality (in hrs) depth (in cms.)					
			0-15	15-30	30-45	45-60	60-75	75-90
1	0.50%	R	72	72	30	26	50	72
		D	72	72	26	26	56	72
		V	72	72	32	28	54	72
2	0.25%	R	72	72	48	30	52	72
		D	72	72	32	32	56	72
		V	72	72	32	30	56	72
3	0.125%	R	72	72	52	48	72	72
		D	72	72	52	48	56	72
		V	72	72	48	48	72	72
4	0.05%	R	72	72	56	48	72	72
		D	72	72	50	32	72	72
		V	72	72	50	48	72	72
5	Control	R	72	72	72	72	72	72
		D	72	72	72	72	72	72
		V	72	72	72	72	72	72

Abbreviations: R = Roorkee, D = Dehradun, V = Vapi experimental stations.

2dimethylcyclopropane-carboxylate. Molecular weight-416.30, ($C_{22}H_9O_3NCl_2$). (*Fig.1*)

Three different types of laboratory and field experiments were conducted to find out its optimum lethal dose suitable for termite management in buildings. Conclusion is drawn and reported at the end after analysis of five years experimental data.

Material and Methods

(I) Modified Ground Board (M.G.B.) Test:

The known concentrations and volume of Cypermethrin 25 E.C. was applied to 43 sq.cm. of soil surface area at the rate of 3 ltrs/m^2. The treated soil was covered with polyethylene vapour barrier

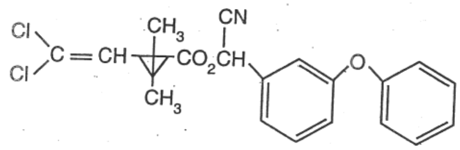


Fig.1: Chemical structure of Cypermethrin 25 E.C.

after the chemical solution has been soaked. A 10 cm diameter capped PVC pipe was placed in the center of the plot to serve as an inspection port. The vapour barrier was removed from inside the pipe and a short perishable test block (*Mangifera indica*) (size 2" x 2" x 2") was placed, resting on the soil surface throughout the duration of the test period. The soil and vapour barrier surrounding the inspection port was covered with a 2.5 cm layer of concrete. (*Fig.2*)

The test was started in three different climatic and soil conditions in India *viz.* Roorkee, Dehradun and Vapi (Gujarat). There were three replicas of each concentration in each experimental site. The comparison was made with the test blocks kept on untreated soil under similar conditions. Observations were recorded regularly after every six-month's interval p to five years. (*Table-1, Fig.3-4*)

(II) Determination of Residual-Toxicity:

In order to determine residual-toxicity; the experimental procedure of modified ground board test was slightly changed. A known concentration and volume of chemical solution (3 ltrs/m^2) was applied to the surface of 43 sq.cm. of soil. After the chemical has been soaked into the soil, this was covered with polyethylene vapour barrier. The vapour barrier was covered with a 2.5 cm layer of concrete. Periodically, the soil from different depth was taken for analysis. 75 gms of soil treated with each concentration was collected from different depth underground the soil. Distilled water was mixed to keep moisture content around 20%. The rate of mortality of active termite workers was observed by bioassay method and compared with that of untreated soil (*Table-2*). As soil permeability increases, the potential for pesticides to reach the groundwater by downward leaching increases.

(III) Post constructional anti-termite treatment in buildings:

About 1000 m^2 plinth area of buildings was treated and thus about 250 m^2 treated with each dose. The methodology of treatment was in accordance with *Code of Practice for Anti-Termite Measures in Buildings Part-III, Post Construction Measures, IS: 6313*. Continuous chemical barrier was created (inside as well as outside) to check the entry of termites into buildings. To achieve the goal, the holes were drilled throughout the floor to inject termiticidal fluid. The concentratioins of Cypermethrin 25 E.C. used for treatment of buildings were 0.50%, 0.25%, 0.125% and 0.05% (a/i).

Results and Discussion

In modified ground board test; the observations recorded from all the experimental stations revealed that the test blocks kept over untreated soil started deteriorating within first six months and were eaten away twice in Roorkee and Vapi site. The test blocks kept on the soil treated with 0.25% was found in perfect conditions in all the experimental sites up to 36 months. The highest test dose 0.50% concentration (a/i) were found effective maximum up to 54 months.

In residual toxicity test, the traces of pesticide were not observed in the soil collected from the depth of 0-30 cms. Maximum mortality (100%) were observed within 26 hours on the soil collected from Roorkee and Dehradun sites from the depth of 45-60 cms. The soil collected from the depth of 60-75 cms were observed toxic where 100 per cent termite mortality were recorded within 50 hours, 56 hours and 54 hours on the soil of Roorkee, Dehradun and Vapi sites respectively. There was no pesticide residue detected below the depth of 75 cms, where 100% termite mortality were

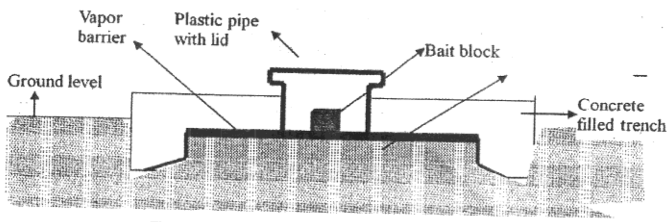


Fig.2: Line diagram of Modified Ground Board Test.

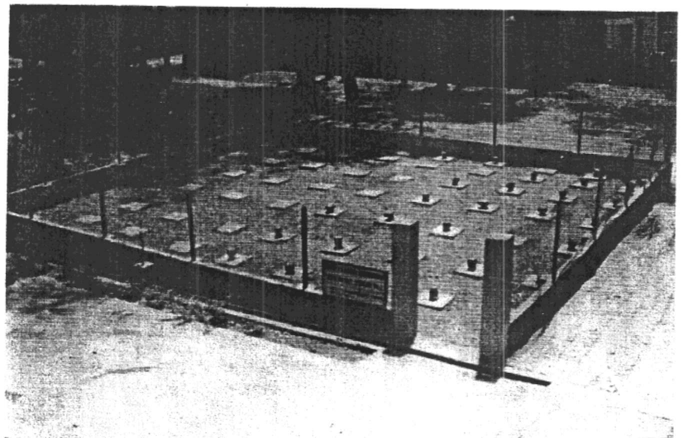


Fig.3: Overall view of experimental site at Roorkee.

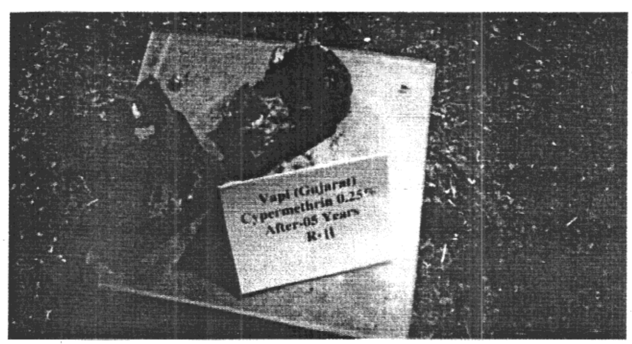


Fig.4: Mango wood-bait on soil treated with 0.25% concentration of Cypermethrin 25 E.C. after five years in Vapi (Gujarat).

recorded within 72 hours, which is equal to untreated check. The soil collected from the depth of 30-45 cms was more toxic than of 45-75 cms. Further, pesticide percolated from topsoil to maximum up to 75 cms deep in the soil underground not below it. The pesticide was completely decomposed after five years from the treated topsoil in all the sites.

Termite infestation was noticed after six months in buildings treated with 0.05% and 0.125% concentration (a/i). Wooden fixture, frames of door and window of dining room, kitchen, bathroom, shoe shelves and electric switch boxes were found attacked. However, there were no sign of termite infestation in the houses treated with 0.25% and above concentrations up to five years.

Conclusion

From the forgoing results and discussions of all the experiments, it can be concluded that Cypermethrin 25 E.C. was percolated maximum up to 75 cms undergound in the soil not below it. The soil treated with 0.50% concentration (a/i) was found quite toxic even after five years as 100% mortality of termites were recorded within 26-32 hours on soil samples, which were collected from 30-45 cms depth. Minimum 0.25% concentration (a/i) and above of Cypermethrin 25 E.C. is found effective up to five years for termite management in buildings.

Acknowledgement

The author is thankful to Director, Central Building, Research Institute, Roorkee for providing necessary facilities to carry out experimental work and to Director, United Phosphorus Ltd., Mumbai for sponsoring the project. Thanks are also due to Director, Jai Research Foundation (JRF), Vapi and Dr. T.G. Marvania, Head, Entomology Dept., JRF, Vapi (Gujarat) for making necessary arrangements in experimental station at Vapi.

Bibliography

Atelier International Cypermethrin/lutte antiacridienne, Rhone-Poulenc, Lyon, 3-5, May 1995.

Barry A. Richardson, 1991: Defects and deterioration in buildings, E & F. N. Spon, University Press, Cambridge.

Bonabeau, E. *et al* 1998: A model for the emergence of pillars, walls, and royal chambers in termite nests. *Philos. Trans. Biol. Sci.* 353: 1561-1576.

Choosing a termite treatment chemical, Michael Merchant, Urban Entomologist, Texas Agricultural Extension Service, Roger Gold, Professor, Department of Entomology, The Texas A&M University System, Insect F@stsheets:House and Garden Series;F@stsheet Ent-1005.

Code of Practice for Anti-Termite Measures in Buildings, Part-III, Post-Constructional Measures IS: 6313-2001.

Dursban elimination in U.S. Environmental Protection Agency, June 8th, 2000.

Evaluation on: Cypermethrin use as a public hygiene insecticide, Issue No. 187, The Health and Safety Executive, U.K. 1999.

Extension Toxicology Network (ETN), 1996: Cypermethrin Pesticide Information Profiles. *http:/ace.orst.edu/cgi-bin/mfs/01/pips/cympermet.htm*

Georgia Pest Management News Letter, June 2001, Volume 24, No. 6.

Hamon, HM, H. Gamboa and JEM Garcia, 1996, Cypermethrin: a major advance for the control of boll weevil in Columbia, In: GA Herzog, DA Hardee (Chairs), RJ Ottens, CS Ireland and JV Nelms (eds), Proceedings Beltwide Cotton Conferences US, Vol 2, Jan 9-12, 1996 Nasville, TN, Cotton insect research and control conference, NCC Memphis, TN, PP 990-994.

Henderson, G *et al.* 1998: Subterranean termites (Isoptera: Rhinptermitidae) attack on ground monitors around an apartment complex in fixed pattern placements versus conducive placements. *Fla. Entomol.* 81: 461-464.

Jain, S.K. and Sanjay Pant (2004): Revision of National Building Code of India: A Model Code for Local Bodies for Building and Development Control. "Good Governance India" Vol.2, Jan.-Feb. 2004, pp-26-31. Published by "Fairfest" Media Ltd., Calcutta.

Mathur S.C. Future of Indian pesticides industry in next millennium. *Pesticide Information 1999*; XXIV (4): 9-23.

Mouldin, Joe K., Jones, Susan C. and Beal, Raymond H., Soil Termiticides, A review of efficacy data from field-test, IRG Secretariate, Stockholm, Sweden, Document No. IRG/WP/1323, March 31, 1987.

Mueller-Beilschmidt, Doria. 1990. "Toxicology and environmental fate of synthetic pyrethroids: *Journal of Pesticide Reform.* 10(3): 32-37.

Naumann, K (1990): Synthetic pyrethroid insecticides: Structures and properties: Chemistry of plant protection, Vol.4, Springer, Verlag, NY.

Norman, E. Hickin, Termites – A world problem Huthinson and Co. London (1971).

Panda, P *et al* 1998: Evaluation of some insecticides against termites on sesamum in Orissa. *Ann. Plant. Protect. Sci.* 6: 118-120.

Pesticide use in India trebled in 8 years, press trust of India, New Delhi Dec. 7, 2001.

Pesticide level high in Punjab farmers' blood. Chandigarh, HT. June 9th, 2005.

Rathore, N.S. (2003): TErmite (Insecta: Isoptera) fauna from Rajasthan. Conference cum workshop on termites and roaches, Vapi Nov. 21-23, 2003.

Su, N-Y *et al.* 1998: Elimination of subterranean termite populations from the Statue of Liberty National Monument using a bait matrix containing an insect growth regulator, hexaflumuron *J. Amer. Inst. Conserv.* 37: 282-292.

U.S. EPA. 2000: For your information, Synthetic pyrethroids for mosquito control, Washington, DC May.

Your soft drink has pesticides: study. HT, Correspondant, Aug. 6th 2003.

Websites:

www.pctonline.com
www.pestworld.org
www.schoolipm.ifas.ufl.edu
www.pestcontrolmag.com
www.gracepestcontrol.comTrea
www.academicpest.com
www.utoronto.ca
www.suburbanpestcontrol.com
www.greenbuilder.com
www.pest.ifas.ufl.edu
www.termitebites.com

Scientists build new mosquito laser gun to eradicate malaria

A team of US-based scientists is giving a new meaning to the term 'WMD' - Weapon of Mosquito Destruction!

The Seattle-based team, led by astrophysicist Dr. Lowell Wood, is developing a new laser gun that locks onto air-borne insects, *The Wall Street Journal* reported.

The technology is derived from work conducted during the 'Star Wars' anti-missile programme. A quarter-century ago, American rocket scientists proposed a defence system, dubbed 'Star Wars', to knock Soviet missiles from the skies with laser beams.

"We like to think we made some contribution back then to the ending of the cold war," said astrophysicist Dr. Jordin Kare, who worked on both projects. "Now, we're just trying to make a dent in a war that's claimed a lot more lives."

The WMD laser works by detecting the audio frequency created by the beating of mosquito wings. A computer triggers the laser beam, which burns off the mosquito's wings, and its smoking carcass falls to the ground.

What's more, the technology is discerning enough to be able to tell a female from a male mosquito based on the beating of the wings. As only the female transmit malaria, this could help prevent unnecessary deaths.

The scientists killed their first mosquito with a hand-held laser in early 2008.

But deciding the strength of the weapon is a key issue: The laser has to be weak enough to not harm humans and smart enough to avoid hitting useful bugs.

"You should kill billions of mosquitoes a night, and without harming any butterflies," the researcher said.

They envision their technology might one day be used to draw a laser barrier around a house or village that could kill or blind the bugs. Alternatively, laser-equipped drone aircraft could track bugs by radar, sweeping the sky with death-dealing photons.