EVALUATION OF THE RELATIVE EFFICIENCY OF CHLOROZAN ® AND HELBAN ® AGAINST *Psammotermes hybostoma* (Desn.) IN SANDY SOIL IN FAYOUM GOVERNORATE, EGYPT

Nadia A. Abd El-Latif and Sanaa A. M. El-Sawi

1- Plant Protection Research Institute, A.R.C., Ministry of Agriculture.

2- Central Laboratory of Residues Analysis of Pesticides and Heavy Metals in Food, A.R.C., Ministry of Agriculture.

ABSTRACT

The present study was conducted at El-Hashatra village, Yousf El Sedek district, Fayoum governorate for 33months. Chlorozan 48% and Helban 48% were tested against the subterranean sand termite *P. hybostoma*; the active ingredient of each is chloropyrifos. A building of 5 rooms was chosen for experimentation. The room represented a replicate. Corrugated cardboard traps were used for 3 months to determine foraging activity. In a complete randomized design, a dose of 4L/trench 2% aqueous emulsion was used. Five treatments were applied in each room; two treatments for Chlorozan being one beneath earthen floor and the other beneath cement slab. For Helban termiticide similar treatment was applied. Control treatment (5 trenches) received only 4L water/ trench.

Results showed that infestation varied and indicated the efficiency of these termiticides for controlling termites. The least number of infested traps was recorded in soil treated with Chlorozan beneath cement slab followed by soil treated with Helban termiticide beneath cement slab then soil treated beneath earthen floor compared with control treatment.

Helban was less effective when applied beneath earthen floor, where complete protection was for 6 months, whereas in treated soil beneath cement slab 100% protecting was for 14 months. Chorozan results showed more stable effects. The full protection was extended to 15 months in treated soil beneath both earthen floor and cement slab.

Chemical analysis of treated soil after 33 months indicated that residues of Chlorpyrifos in Helban beneath earthen floor was 0.03 - 2.4 ppm and that beneath cement slab was 0.04 - 68.0 ppm. The residues with Chlorozan treatments ranged between 0.07 - 123.0 ppm in earthen floor and 0.65 - 185.0 ppm in that beneath cement slab. The lowest concentration of Chlorpyrifos that gave protection from subterranean termites infestations was 13.3ppm.

Key wards: *Psammotermes hybostoma*; Chlorozan; Helban; Sandy soil; Chemical analysis.

INTRODUCTION

Termites are social insects that belong to order Isoptera. One of the predominant subterranean species in Egypt is *Psammotermes hybostoma* Desneux, Family Rhinotermitidae; is the most economically important causing considerable damage to house woods sound or decayed, lying on or in contact with the ground in the border of the delta, new valley, upper and middle Egypt **(Kaschef & El-Sherif, 1971 and Ali, 1980.**

Allover the world, termite control depends on insecticides either placed on the soil or as trench system treatments to form chemical barriers. Such barriers are effective when properly applied but require large quantities of long-lasting insecticides.

The use of chemicals producing a layer of soil which is lethal or repellent to termites is a useful method. For this purpose, Creosote oil, Sodium arsenite, Pentachlorophenol, Sodium pentachlorophenate, Copper naphthenate, DDT, Benzene hexachloride, Chlordane and Dieldrin were used. These termiticides have provided insecticidal activity in soil for more than 20 years. However, due to human health and environmental concerns, the U.S. Environmental Protection Agency (EPA) has canceled these termiticides. Of the currently registered active ingredients labeled for controlling subterranean termites, Chlorpyrifos has been the most widely used by commercial pest control operators. Length of time over which these chemicals remain effective depends on a number of factors including soil type, climatic conditions and species of termites involved **(Harris, 1961 and Davis & Kamble, 1992).**

The use of persistent pesticides for termite control, which eliminate pest populations directly or prevent their invasion into structures was carried out by several authors **(Gold *et al.*, 1993; El-Nagger & Abd El-Latif, 2007; Sheikh, 2009 and Lin Yan, 2010.**

The Persistence and determination of Chlorpyrifos levels in the ambient air and soil of houses four and eight years after application for termite control in USA. were conducted by **Wright *et al.*, 1991 and 1994; Nanyao *et al.*, 1999; Gold *et al.*, 1993; Kulkarni *et al.*, 2000; El-Nagger & Abd El-Latif, 2007; Davis and Kamble, 2009 and Sheikh, 2009.**

The aim of this work was to study the efficiency and persistence of Chlorpyrifos in two recommended soil termiticides (Chlorozan 48% and Helban 48%) and to determine the residues remaining 33 months after application in sand soil of houses for the control of the subterranean sand termite *P. hybostoma* using trench system treatments beneath earthen and cement floors under natural Fayoum environmental conditions.

MATERIAL AND METHODS:

The present study was conducted at El-Hashatra, village, Yousf El Sedek district, Fayoum governorate. The experiment lasted for 33 months. The chosen building was known to be heavily infested with *P. hybostoma* and was not treated with any termiticides. Physical and chemical analysis of Fayoum soil (table 1) was conducted at the Central Laboratory of Soil Analysis, Faculty of Agriculture, Fayoum University.

Table (1): Type and physico-chemical characteristics of the soil of the experimental area at Fayoum location.

Location	Texture class	Mechanical analysis		
		Sand %	Silt %	Clay %
Fayoum governorate	Sandy	89.4%	5.1	5.5

Chemical analysis							Ec mem/ cm	pH	OM %
Soluble cations meq./L			Soluble anions meq./L						
Ca^{++} $+Mg^{++}$	Na^{+}	K^{+}	$CO3^{=}$	$HCO3^{-}$	Cl^{-}	$SO4^{=}$			
81	144	65.8	0.0	14.8	242.8	33.3	28.03	7.35	2.64

The main line of defense against termites is normally a barrier to keep termites away from the building. To treat a house with earthen floors, a trench along side of foundation walls from inside was made. The building contained 5 rooms, every room was considered as a replicate, termiticides and control were distributed in complete randomized design. The experimental area was carefully cleaned up of any cellulose debris. Corrugated cardboard traps were used in this work for 3 moths to determine foraging activity. 5 trenches were made in each single room just below the wall foundation from inside in area highly infested. A dose of 4L of termiticide solution per length metre 2% concentration was applied. Two recommended soil termiticides (Chlorozan 48% and Helban 48%) were tested against the subterranean sand termite *p. hybostoma*. Five treatments with five replicates were used in this experiment. 25 trenches (25 replicates), 10 trenches for each termiticide (5 trenches beneath earthen floor and 5 beneath cement slab), trench was made in soil (30cm deep x 30cm wide x one metre long) with 2 metres distance apart. The control treatment was received only 4L water/ trench. Trenches were left till complete absorption of treatments, then the removed soil was held back to refill the trench to soil level. Corrugated cardboard traps were dried at 105°c for 24h and weighed, then thoroughly moistured with water and vertically buried into the soil in the middle of each trench and replaced monthly by new ones. Cement slab with 30cm wide and one metre long was placed on every trench. A hole in the middle measuring (7cm.dia. x 5cm ht.) was made of every cement slab. PVC trap was pushed into the cement slab in the middle. The removed traps were employed to obtain food consumption, soil translocation and the number of different castes. To determine the residues of Chlorpyrifos for the tested termiticides, 25 soil samples from the treated and control trenches were taken 33 months after application (5trt.x5reps.); 200 g/trench.

Chemical analysis:

The procedure of **Lehotay *et al.*, (2005)** as a QuCHER method was used for extraction and purification of pesticide residues from soil samples. Soil sample (10 g) was weighted into a 50 ml PFTE tube and dissolved in 10 ml deionized water by shaking for one minute. Acetonitrile acidified with acetic acid (10 ml), 1.0 g sodium acetate and 4.0 g anhydrous magnesium sulphate were added and shaken vigorously for one minute. The samples were centrifuged at 4000 rcf for 2 min. Six ml. of the upper clear solution (extracts) was transferred into 15 ml polyethylene tube containing 0.4 g primary secondary amine (PSA) sorbent and 0.6 g anhydrous magnesium sulphate. The tubes were caped, then the extract with the sorbent/ dessicant was mixed vigorously for one minute and centrifuged at 4000 rcf for 2 min. Four ml. of the clear solution was transferred into 15 ml glass tube and 50 µl tetradecan was added as keeper and evaporated in turbovab at 40 °C to dryness. The residues were dissolved in 2 ml of acetonitril and then injected in GC-NPD.

Parameters of GC- NPD

GC-NPD (6890 Series)

- The gas chromatography instrument was adjusted for:
  Injector = 225 °C Detector temp A = 280 °C
  Detector temp B = 280 °C
  Columns:

a) PAS-5 (Cross linked 5% PH ME Silicone)
   Column ID: 0.32 mm Film thickness: 0.25 um Column length: 25 m

Flow rate of Nitrogen 1.5 ml / min.

b) PAS – 1701 (ECD Tested 1701 Silicone)

Column ID: 0.32 mm Film thickness: 0.25 um Column length: 30m

Flow rate of Nitrogen 1.3 ml / min, Air flow: 60 ml /min, Carrier gas: Nitrogen.

Detector A: make up gas (N_2) flow rate 8 ml/min, H_2 flow rate: 4.5 ml/min.

Detector B: make up gas (N_2) flow rate 6 ml/min, H_2 flow rate: 4.8 ml/min.

Septum purges 5 ml/min, splitless time: 0.75 min, purge flow: 34 ml/min.

Oven program:

Initial temp: 90 °C Initial time: 2 min

	Rate (°C/min)	Temp (°C)	Time(min)
Level (1)	20	150	0
Level (2)	6	270	5

RESULTS AND DISCUSSION:

Data in table (2) showed that all termiticide treatments used were effective in controlling subterranean sand termites *P. hybostoma* where the control treatment was heavily infested with termite as shown in fig 1. During the period experimentation (33 months), the traps showed different degrees of infestation. The least infested traps were those in soil treated with Chlorozan beneath cement slab (3 traps of 165 traps (1.82%) throughout 33 months followed by that in soil treated with Helban beneath cement slab (5 traps of 165 traps 3.03%). More traps were infested (20 and 19 with 12.12 and 11.52% in soil treated with Chlorozan and Helban termiticides beneath earthen floor, respectively, compared with control treatment with 123 infested traps of 165 (74.55%).

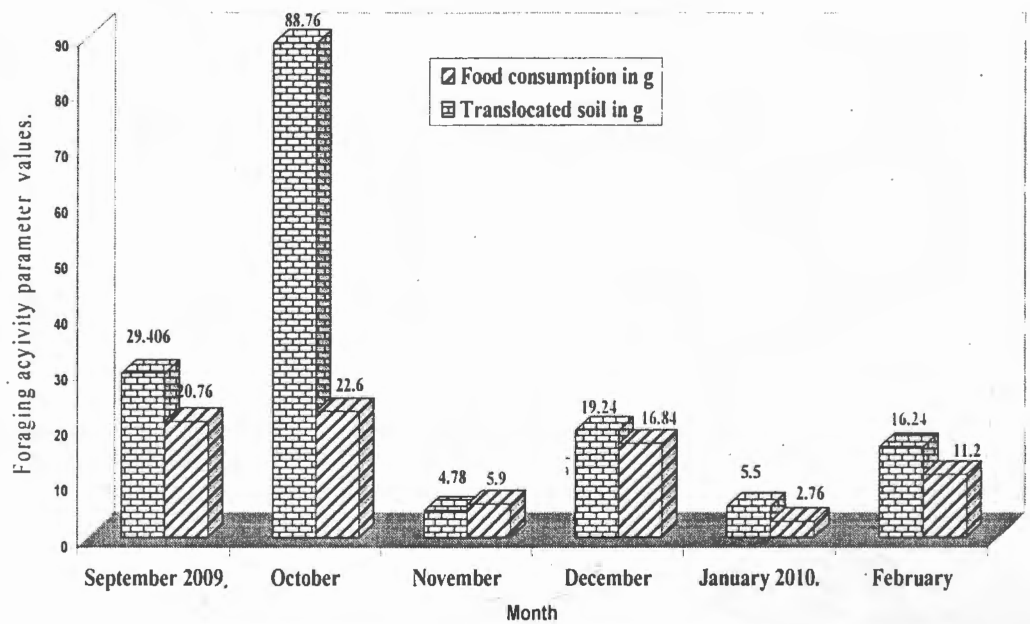

Fig. (1):Mean of foraging activity parameter values/trap of *P. hybostoma* termite for control (untreated soil with termiticid throughout the first six months of the experiment at Fayoum location .

Data in tables (2 and 3) indicated that the initial infestation for traps in soil treated with Helban termiticide beneath earthen floor, was after 7 months. Initial infestation for traps in soil treated with Helban termiticide beneath cement slab was after 15 months. With Chlorozan termiticide beneath earthen floor or beneath cement slab; 16 months elapsed before initial infestation occurred. Therefore, Helban was the least effective when applied beneath floor (100% protected for 6 months only) while this protection was 14 months when applied beneath cement slab. In case of Chorozan, results showed more effectiveness and gave 100% protection for 15 months when applied beneath both earthen floor and cement slab.

Helban termiticide beneath earthen floor gave protection period from the subterranean termite infestation ranged from 6-31 months and from 14- 33 months in treated soil Helban termiticide beneath cement slab. Protection ranged from 15 - 33 months in treated soil with Chlorozan beneath both earthen floor and cement slab.

Chemical analysis results obtained after 33 months indicated that the residues remaining of Chlorpyrifos in treated soil with Helban termiticide beneath earthen floor ranged from 0.03 to 2.4 ppm and from 0.04 to 68.0 ppm in treated soil with Helban termiticide beneath cement slab. While, for chlorozan the residues ranged from 0.07 to 123.0 ppm in treated soil beneath earthen floor and from 0.65 to 185.0 ppm in treated soil beneath cement slab. In this respect, **Racke *et al.*, 1993** stated that application of Chlorpyrifos as a termiticidal soil barrier resulted in initial residues of several hundred ppm in the soil, nearly 70% of the initially applied Chlorpyrifos remained in the soil after 18 months. **Wright *et al.* (1994)** showed that Chlorpyrifos was detected in the soil adjacent to the exterior and interior foundation walls for all houses at 8 years ranged from 0 to 396 ppm and 0 to 439 ppm, respectively. The persistence of Chlorpyrifos depended on several factors, such as variations in the application rate and technique, sampling locations around the houses and the site soil characteristics.

As seen in table (3) after 33 months the percentage of infested trenches with subterranean termite was high and reached 100% in treated soil with Helban termiticide beneath earthen floor. While it reached 40% after 33 months in treated soil with Helban termiticide beneath cement slab and in treated soil with Chlorozan termiticide beneath both earthen floor and cement slab.

The lowest concentration of Chlorpyrifos gave protection from subterranean termite infestation was 13.3ppm and penetration occurred through 2.4ppm. In this respect, **Sheikh *et al.* (2008)** stated that Terminus (Chlorpyrifos) in soil was repellent at 480ppm and 240ppm for *Heterotermus indicola* (Wasmann) and penetration occurred through 30, 60, and 120ppm. **Davis and Kamble (2009)** detected a minimum amount of 4 Mg/g (4ppm) was used as a measure to control subterranean termites. **Sheikh (2009)** indicated that Dursban was repellent at somewhat higher doses, i.e. 480ppm.While **Van *et al.* (2010)** indicated that the threshold concentration which was defined as the lowest concentration to totally stop termite's penetration of Chlorpyrifos was between 8-10 mg/kg.

In general it could be concluded that treatment of soil below the wall foundations with Chlorozan or Helban before building construction is promising against termites as well as treating the infested constructed buildings on cement concrete slab.

It is not recommended to use Helban termiticide to treat buildings with earthen floor and this is probably due to fast evaporation of this termiticide which might be a limiting factor in facilitating termiticide movement from treated soil under Egyptian environmental conditions in sandy soil with pH of 7.35and 2.64% organic matter.

Table (2): Foraging activity parameter values of *P. hybostoma* termites in treated soil with termiticides at Fayoum location throughout 33 months.

Treatment	Month	Foraging activity values g / trap				
		R1	R2	R3	R4	R5
Chlorozan (1)	March 2010	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**1.1**	**0.0**	**0.0**	**0.0**
		0.0	2.1	0.0	0.0	0.0
		0.0	15	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**27.8**	**0.8**	**1.7**	**3.5**	**0.0**
		45.6	1.2	14.5	11.5	0.0
		0.0	0.0	0.0	175	0.0
Chlorozan (1)	April	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**27.5**	**23.3**	**29.5**	**24.4**	**27.8**
		27.89	46.9	38.51	8.7	27.9
		51	0.0	0.0	0.0	0.0
Chlorozan (1)	May	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0**	**3.2**	**28.5**	**25.4**	**0.0**
		0.0	17.3	39.8	22.4	0.0
		0.0	0.0	0.0	0.0	0.0
Chlorozan (1)	June	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**25.5**	**0.0**	**28.5**	**26.2**	**0.0**
		10.75	0.0	23.1	9.8	0.0
		0.0	0.0	0.0	0.0	0.0

Represent trenches beneath earthen floor. (2)Represent trenches with cement slab

***Bold figures in every square represent food consumption in g.**

* Regular figures in every square represent translated soil in g.

* *Italic figures in every square represent the number of different castes.*

Chlorozan (1)	July	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**24.1**	**16.8**	**22.5**	**0.0**	**0.0**
		0.0	2.58	5.2	0.0	0.0
		0.0	516	0.0	0.0	0.0
Chlorozan (1)	August	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**1.5**	**12.5**	**3.5**	**0.0**	**0.0**
		1.7	25.3	21.8	0.0	0.0
		0.0	351	0.0	0.0	0.0
Chlorozan (1)	September	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0**	**26.3**	**26.8**	**26.3**	**26.9**
		0.0	69.6	26.9	4.14	6.41
		0.0	0.0	0.0	0.0	0.0
Chlorozan (1)	October	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**٥,٥**	**0.0**	**0.0**	**0.0**
		0.0	٢٥,٦	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**39.2**	**29.9**	**30.3**	**25.6**	**25.2**
		62.2	47.5	53.4	10.8	42.9
		0.0	0.0	0.0	0.0	0.0
Chlorozan (1)	November	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		**0.0**	**3.5**	**0.0**	**0.0**	**0.0**
		0.0	18.7	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
control		**0.5**	**2.5**	**3.8**	**1.5**	**4.522**
		0.0	7.3	19.5	10.3	22.1
		0.0	0.0	0.0	0.0	381
Chlorozan (1)	December	**0.0**	**0.0**	**0.0**	**0.0**	**4.2**
		0.0	0.0	0.0	0.0	22.3
		0.0	0.0	0.0	0.0	65
Chlorozan (2)		**0.0**	**0.0**	**0.0**	**0.0**	**1.8**
		0.0	0.0	0.0	0.0	3.2
		0.0	0.0	0.0	0.0	95

Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.5** 2.2 0.0	**25.5** 37.2 0.0	**8.5** 45.2 125
Chlorozan (1)	January 2011	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.2** 1.5 72
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.5** 3.5 45	**3.8** 21.5 659
Chlorozan (1)	February	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.5** 3.2 0.0	**24.5** 35.5 35
Chlorozan (1)	March	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**2.5** 21.6 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0** 0.0 0.0	**5.5** 24.5 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0** 0.0 0.0	**22.5** 27.6 370	**0.0** 0.0 0.0	**19.5** 21.8 0.0	**24.2** 14.3 0.0
Chlorozan (1)	April	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**23.6** 19.2 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0** 0.0 0.0	**23.5** 29.18 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**14.3** 2.5 0.0	**0.0** 0.0 0.0	**22.5** 3.2 0.0	**24.3** 41.2 0.0	**23.5** 29.1 0.0

Chlorozan (1)	May	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**21.4** 5.2 100
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0** 0.0 0.0	**1.5** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**25.3** 8.35 0.0	**21.5** 13.7 0.0	**24.9** 19.19 0.0	**0.0** 0.0 0.0	**25.2** 32.73 0.0
Chlorozan (1)	June	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**22.7** 5.5 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**24.5** 18.3 0.0	**24.6** 12.5 0.0	**13.8** 6.5 0.0	**2.5** 3.4 0.0	**0.0** 0.0 0.0
Chlorozan (1)	July	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**6.92** 25.4 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0** 0.0 0.0	**13.5** 2.4 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**3.5** **1.6** 0.0	**2.5** 2.7 0.0	**24.8** 9.6 0.0	**25.2** 27.6 0.0	**25.1** 18.18 0.0
Chlorozan (1)	August	**0.0** 0.0 0.0	**24.8** 18.2 5	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**22.7** 21.5 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
Control		**22.5** 25.7 0.0	**23.3** 31.5 0.0	**24.1** 35.2 0.0	**24.2** 19.3 0.0	**25.3** 36.5 97
Chlorozan (1)	September	**0.0** 0.0 0.0	**8.5** 7.6 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**23.5** 28.5 26
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**0.0**	**8.3**	**0.0**	**0.0**

		0.0	0.0	3.7	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**24.5**	**14.6**	**7.5**	**24.1**	**24.5**
		41.32	32.3	2.9	23.5	95.7
		0.0	39	0.0	0.0	26
Chlorozan (1)	October	**0.0**	**13.6**	**0.0**	**0.0**	**23.9**
		0.0	23.7	0.0	0.0	37.7
		0.0	0.0	0.0	0.0	46
Chlorozan (2)		**0.0**	**24.5**	**0.0**	**0.0**	**0.0**
		0.0	65.3	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**2.2**	**0.0**	**0.0**	**0.0**
		0.0	4.5	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**4.5**	**6.5**	**24.3**	**19.5**	**23.5**
		38.6	23.1	35.3	38.9	35.2
		176	218	432	52	0.0
Chlorozan (1)	November	**0.0**	**23.3**	**0.0**	**0.0**	**25.6**
		0.0	42.2	0.0	0.0	35.2
		0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**3.41**	**0.0**	**0.0**	**21.3**
		0.0	11.5	0.0	0.0	41.6
		0.0	0.0	0.0	0.0	0.0
Helban (2)		**0.0**	**1.6**	**0.0**	**0.0**	**0.0**
		0.0	3.5	0.0	0.0	0.0
		0.0	0.0	0.0	0.0	0.0
control		**0.0**	**4.6**	**5.2**	**5.3**	**62.3**
		0.0	37.8	24.2	21.1	31.2
		0.0	60	0.0	15	5
Chlorozan (1)	December	**0.0**	**1.7**	**0.0**	**0.0**	**2.1**
		0.0	2.7	0.0	0.0	15
		0.0	15	0.0	0.0	1147
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**0.0**	**0.4**	**0.0**	**0.0**	**0.0**
		0.0	1.1	0.0	0.0	0.0
		0.0	9	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
Control		**0.0**	**0.7**	**1.3**	**0.0**	**1.2**
		0.0	0.8	1.5	0.0	3.5
		0.0	0.0	0.0	0.0	12

Chlorozan (1)	January	**0.0** 0.0 0.0	**0.7** 1.3 5	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.3** 2.2 6
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control	2012	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.7** 2.8 19
Chlorozan (1)	February	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		0.0	0.0	0.0	0.0	0.0
Helban (2)		0.0	0.0	0.0	0.0	0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**1.7** 21.5 97	**0.0** 0.0 0.0	**0.5** 1.5 225
Chlorozan (1)	March	**0.0** 0.0	**0.2** 1.2	**0.0** 0.0	**0.0** 0.0	**0.0** 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**22.5** 81.9 65	**12.1** 47.4 0.0	**10.7** 33.1 115	**2.7** 3.2 260	**0.0** 0.0 0.0
Helban (2)		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.7** 0.9 0.0	**0.0** 0.0 0.0
control		**1.5** 2.4 0.0	**0.0** 0.0 0.0	**1.3** 4.2 0.0	**1.4** 2.5 75	**9.8** 31.5 0.0
Chlorozan (1)	April	**0.0** 0.0	**26.5** **37.9**	**0.0** 0.0	**0.0** 0.0	**0.0** 0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**1.1** 1.7 17	**14.4** 17.9 254	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.2** 0.0 ٦٣	**0.0** 0.0 0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**14.2** 21.9 25	**1.7** 4.2 185	**1.9** 5.4 105
Chlorozan (1)	May	0.0	0.0	0.0	0.0	0.0
Chlorozan (2)		0.0	0.0	0.0	0.0	0.0
Helban (1)		**1.7** 1.2 42	**18.9** 31.5 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0
Helban (2)		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**0.0** 0.0 0.0	**3.5** 25.7 47	**0.0** 0.0 0.0
control		**0.0** 0.0 0.0	**0.0** 0.0 0.0	**14.5** 15.9 0.0	**24.9** 44.5 0.0	**24.6** 47.7 0.0

Table (3): Months elapsed before initial infestation with *P.hybostoma,* in treated trenches and Chlorpyrifos residues in soil 33 months after application under Fayoum environmental conditions.

Treatment	Chlorpyrifos residues in soil Mg /Kg. per trench					
Treatment	Trench 1	Trench 2	Trench 3	Trench 4	Trench 5	%infested trenches after 33 months
Chlorozan (1)	**0** 0 164	**24** 8 0.23	**0** 0 *123.0*	**0** 0 *14.4*	**16** 12 *0.01*	40
Chlorozan (2)	**0** 0 185.0	**26** 1 0.77	**0** 0 13.3	**0** 0 120.7	**16** 2 0.65	40
Helban (1)	**31** 3 2.4	**7** 12 0.03	**25** 2 0.76	**31** 1 0.85	**27** 1 0.73	100
Helban (2)	**0** **0** 68.0	**15** 2 0.04	**0** 0 16.6	**31** 3 0.11	**0** 0 35.7	40
control	**1** 21 0.0	**1** 21 0.0	**1** 29 0.0	**1** 26 0.0	**1** 26 0.0	100

***Bold figures in every square represent month recorded of initial infestation**

* Regular figures in every square represent number of months recorded of initial infestation

* *Italic figures in every square represent* Chlorpyrifos residues in soil Mg /Kg.

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تقييم الكفاءة النسبية لاثنين من مبيدات النمل الأبيض (الكلورزان والهلبان) فى مكافحة النمل الأبيض *Psammotermes hybostoma* فى التربة الرملية فى محافظة الفيوم- مصر

نادية عبد الشفيع عبد اللطيف [1] و [2] سناء عبد القادر الصاوى

١- معهد بحوث وقاية النباتات - مركز البحوث الزراعية- وزارة الزراعة

٢- المعمل المركزى لتحليل متبقيات المبيدات والعناصر الثقيلة فى الأغذية - مركز البحوث الزراعية - وزارة الزراعة

أجريت هذه الدراسة فى قرية الهشاترة - بمركز يوسف الصديق فى محافظة الفيوم و قد إستغرقت هذه التجربة ٣٣ شهرا. إختبر إثنان من مبيدات النمل الأبيض الموصى بهم فى التربة (الكلورزان ٤٨% و الهلبان ٤٨%) لمكافحة نمل الرمال الأبيض *Psammotermes hybostoma* وكانت المادة الفعالة لكلا المبيدين هو الكلوربيريفوس. إختيرلهذه التجربة مبنى مكون من خمس حجرات مثلت الحجرة مكررا. استخدمت المصائد الكرتونية لمدة ٣ شهور لتحديد نشاط السروح. وزعت المعاملات بنظام التام العشوائى. استخدمت جرعة من المبيد ٤ لتر/خندق فى شكل مستحلب مائى بالتركيز الموصى به ٢%. وكان عدد المعاملات ٥ في كل حجرة. معاملتان لمبيد الكلورزان، معاملة طبق فيها المبيد أسفل الطبقة الترابيه والمعاملة الأخرى طبق فيها المبيد أسفل الطبقة الأسمنتية. وتمت المعاملة لمبيد الهلبان بنفس طريقة المبيد السابق. و٥ خنادق لمعاملة المقارنة استخدم فيها الماء فقط بمعدل ٤ لتر/ خندق. وقد أظهرت النتائج نسب مختلفة من الاصابة بالنمل الأبيض و الكفاءة لكلا المبيدين فى مكافحة النمل الأبيض. وكان أقل عدد من المصائد الكرتونية المصابة كانت فى التربة المعاملة بمبيد الكلورزان تحت الطبقة الأسمنتية تتبعها معاملة مبيد الهلبان تحت الطبقة الأسمنتية.ثم التربة المعاملة أسفل الطبقة الترابيه مقارنة بمعاملةالمقارنة.

أظهرت النتائج ان مبيد الهلبان كان أقل تأثيرا عندما طبق أسفل الطبقة الترابيه حيث أعطى حماية كاملة لمدة ٦ أشهر. بينما أسفل الطبقة الأسمنتية كانت الحماية ١٠٠% لمدة ١٤ شهرا. فى حين أظهرت نتائج المعاملة بالكلورزان أكثر ثباتا وفاعلية حيث إمتدت فترة الحماية إلى ١٥ شهرا للتربه المعاملة اسفل الطبقة الترابيه او أسفل الطبقة الأسمنتية.

وقد تراوحت نتائج تقدير متبقيات مبيد الهلبان(الكلوربيريفوس كمادة فعالة) فى عينات التربة المعاملة أسفل الطبقة الترابيه من٠،٠٠٣ الى ٢،٤ جزء فى المليون و من ٠،٠٠٤ الى ٦٨ جزء فى المليون فى التربة المعاملة أسفل الطبقة الأسمنتية. فى حين تراوحت المتبقيات من ٠,٠٧ الى ١٢٣ جزء فى المليون فى التربة المعاملة بمبيد الكلورزان أسفل الطبقة الترابيه ومن ٠,٦٥ الى ١٨٥ جزء فى المليون فى التربة المعاملة أسفل الطبقة الأسمنتية. و قد وجد أن أقل تركيز من الكلوربيريفوس أعطى حماية من اصابة النمل الأبيض هو ١٣,٣ جزء فى المليون.