J. Agric. Sci. Mansoura Univ., 32 (4): 3071 - 3083, 2007

LABORATORY EVALUATION OF SOME INSECTICIDES AGAINST SUBTERRANEAN TERMITES IN SOIL LAYERS AND ITS RELATION TO THE WATER TABLE.

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ABSTRACT

The obtained results of soil treatments against *Psammotermes hypostoms* (Desn.), indicated that, the three tested insecticides in different groups; chlorpyrifos, fipronil and cypermethrin were highly toxic in sub-surface layers of treated soil contains particle size of >850µm more than other particle sizes 425 and 250µm, respectively, and the fine soil was more safety to the ground water. Fipronil showed the highly toxic effect, followed by cypermethrin and chlorpyrifos, respectively. In coarse soil cypermethrin showed more toxic than other tested insecticides. The results of chemical determination of insecticides residues, data indicated that chlorpyrifos was more save for water table at all particle sizes followed by cypermethrin, while fipronil was the lower safety one, especially in soil particle sizes of 850 and 425µm, respectively. Generally the data of statistical analysis showed significant variations between all tested factors, (insecticides, particle sizes and depths of soil). with the variable, (mortality%).

INTRODUCTION

Subterranean termite is one of the most social insects distributed all over the world. Sandy termites, *P. hypostoms* (Desn.), in Egypt is very important economic as a subterranean termites which attacks any host contained cellulose; wood, trees, buildings, papers and crops. …Etc. Egyptian subterranean termites distributed in the Upper, Lower, Eastern desert, Western desert and Oasis of Egypt and are consider the major species in the desert. The present species is capable to adapt with different soil types and environments. Damage caused by sand termites *P. hypostoma* to rural buildings constructed with mud bricks, woodwork in buildings, agricultural crops, books, government records and other stored products containing cellulose and caused highly economic losses affected on the local income. Recently, control measurements were directed to soil treatments to the different infested targets and such methods were affected on the under ground water as a source of water in different Egyptian locations. The present work was conducted to study the effect of soil treatment with chlorpyrifos, fipronil and cypermethrin against *P. hypostoma* in relation to soil particle size at different depths.

MATERIALS AND METHODS

A. Tested insecticides:

1- Organophosphates group was represented by chlorpyrifos: *O,O* - diethyl *O* - 3,5,6 – trichloro – 2 - pyridyl phosphorothioate as Dursban.48 %

2-Fipronil group was represented by Fipronil: (±) – 5 – amino – 1 - (2,6 – dichloro - ά, ά, ά-trifluoro-*p*-tolyl) – 4 – trifluoromethylsulfinylpyrazole – 3 - carbonitrile as Termidor. 5%

3- Pyrethroids group: was represented by cypermethrin: (*RS*)- ά -cyano-3-phenoxybenzyl (1*RS,*3*RS*; 1*RS,* 3*SR*) – 3 - (2,2 - dichlorovinyl) - 2,2 - dimethylcyclopropanecarboxylate

Roth: (*RS*)- ά -cyano-3-phenoxybenzyl (1*RS*)-*cis-trans*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate as Actamethrin 10%.

B. Preparation of soil:

i. Sandy loamy soil samples were collected from The Regional Agriculture Research Station at Ismailia Governorate, 120km east of Cairo. The soil samples were taken randomly from the different sites at depth of 30, 60, 90cm., where the most termite activity was considered to be within that area. Samples of each level were mixed together to represent one homogenized sample of depth and transmitted to Termite Research unit laboratory, Plant Protection Research Institute for preparation.

ii. Soil samples were screened to three-particle sizes 850, 425 and 250µm using USA Standard Testing Sieve (ASTM. E11. Specification). The screening operation was conducted firstly for particle size 850µm followed by 425µm and then 250µm, respectively.

iii. Soil samples were soaked for two hours under tap water and washed several times to get rid of organic matter and dirties. The washed soils were distributed on stainless tray for dryness at open air and overturned from time to time for 48 hours and then sterilized in an electric oven at 105^{o}C for 24 hours to eliminate the microorganisms' spores and vegetative stages. Samples are kept in plastic containers and placed in deep freezer for the different treatments.

iv. To prepare a concentration of 500ppm for each insecticide, a volume of 1.04 ml of chlorpyrifos, 10 ml fipronil and 5.0 ml cypermethrin was dissolved in 200 ml acetone.

v. The washed soil was spread on a clean stainless tray at 1cm height and sprayed with formulated prepared insecticide to represent 500ppm /1kg. Treated soil was shacked by electric shaker for 48 hours. Homogenized treated soil was kept at a glass jars inside deep freezer.

C. Insects collection:

The subterranean termites, *P. hypostoma* were collected from Regional Agriculture Research Station, using El-Sebay modified trap, 1991. Termites were separated from the traps and kept at 27C◦ ±1C◦. Daily inspection was carried out and eliminated dead or moribund individuals. The healthy workers were used for the insecticides evaluation, El-Sebay, (1993a&b); El-Bassiouny (2001) and Ahmed (1997 & 2003).

D. Experimental technique:

To study the vertical movement of insecticides in the ground and it's leaching, hundred centimeters long of PVC tube was divided into 10 pieces, represented 10 depths, each measured 10cm in length and 2.5cm in diameter, and represented 25 gm in volume. The pieces were attached together again by plaster band to give the same previous column. The column was closed from bottom by muslin cloth and fixed with rubber band. All columns were hanged

into designed wooden stand to keep it vertically. Column was filled with a certain particle size of untreated soil from segment number 2 to segment number 10. Segment number one was filled with soil treated by 500ppm from each tested insecticide. Each insecticide was repeated three times according to every particle size, (three sizes of soil particles were chosen; 850, 425 and 250µm.). Each column for each soil particle size was replicated five times. 200 ml of water (average rain fall at Delta region) was leach gradually from the first segment to receive the access of leach water from the last segment through a glass cup. Installed columns were left for 24 hours. Each column was re-divided into its marked pieces, hence fore emptied into aluminum dish and left for dryness in open air. 5gm from each marked segment was placed in a Petri-dish, and 20 healthy workers of termites were liberated, provided with moistened cardboard. Each treatment for each depth, and control were replicated five times. Mortality percentages were recorded for 7 days.

Another٬٬ grams were sent to determination of insecticide residues in treated soil.

The obtained data was analyzed using Proc ANOVA in SAS (SAS Institute 1988).

E. Residues determination of tested insecticides in treated soil samples:

The original method of **Davis *et al*. (19٩3),** was used with some modification, and each pesticide was determined separately in the absence of others insecticides. The methods could be concluded as follows:

Three different methods were selected in determination of insecticides, (chlorpyrifos, fipronil and cypermethrin) in soil samples were extracted by the solvents, acetone, dichloromethane and ethyl acetate.

i. Recovery of insecticides residues from the treated soil:

Different solvent systems were used to choose the most suitable and efficient solvent system for extraction of chlorpyrifos, fipronil and cypermethrin from treated soil. These solvent systems were acetone**,** dichloromethane and ethyl acetate. There ability to extract the tested insecticides successfully was tested by adding the previously mentioned solvents to samples. Blending, cleaning-up and then determining the recovery percentage of the three tested compounds by GLC.

Results are shown in Table (1). Extraction of the tested insecticides from treated soil was tested by three different solvents namely: acetone**,** dichloromethane and ethyl acetate. The most suitable of which was dichloromethane with 94.0, 91.1 and 90.2% percent recovery, and ethyl acetate gave 88.3, 89 and 84.3% while using acetone 85.4, 82 and 85.4% percent recovery, for chlorpyrifos, fipronil and cypermethrin respectively.

As shown in table (2). Data revealed that, the rate of recoveries by 500ppm in soil treated with three insecticides and the rates was follow; the replicates of chlorpyrifos recorded 93.0 and 95.0% with average 94.0%, the fipronil estimated 82.0 and 83.5% with average 82.75%, and the cypermethrin estimated 86.5 and 91.5% with average 89.0%. The obtained data of the insecticides residues were corrected according the previously results.

Table (1): Recovery results of three solvents for the tested insecticides in treated soil samples.

Tested pesticide	Solvent	Recovered (ppm) 5ppm		% Amount recovered		Average %
		R 1	R2	R 1	R2	
Chlorpyrifos	Acetone	4.21	4.33	84.2	86.6	85.4
	Dichloromethane	4.66	4.74	93.2	94.8	94.0
	Ethyl acetate	4.52	4.31	90.4	86.2	88.3
Fipronil	Acetone	4.15	4.22	83	84	82
	Dichloromethane	4.65	4.46	93	89.2	91.1
	Ethyl acetate	4.33	4.57	86.6	91.4	89
Cypermethrin	Acetone	4.33	4.21	86.6	84.2	85.4
	Dichloromethane	4.57	4.45	91.4	89	90.2
	Ethyl acetate	4.22	4.21	84.4	84.2	84.3

Table (2): The amount recovered for tested insecticides, in soil treated with 500ppm.

Insecticides	Amount recovered In ppm		Recovered %		Average %
	R 1	R2	R 1	R2	
Chlorpyrifos	465	475	93.0	٩٥.0 %	94
Fipronil	410	417.5	82.0	83.5 %	82.75
Cypermethrin	432.5	457.5	86.5	91.5	89

ii. Analysis condition of tested insecticides:

- **Chlorpyrifos**

Detector: electron capture
Column temperature: 180 °C
Detector temperature: 300 °C
Injection temperature: 250 °C
Column type: HP – 1 (25 m × 0.23 mm × 0.17µm)

- **Fipronil**

Detector: electron capture
Column temperature: 200 °C
Detector temperature: 300 °C
Injection temperature: 250 °C
Column type: HP – 1 (25 m × 0.23 mm × 0.17µm)

- **Cypermethrin**

Detector: electron capture
Column temperature: 250 °C
Detector temperature: 300 °C
Injection temperature: 270 °C
Column type: HP – 1 (25 m × 0.23 mm × 0.17µm)

RESULTS AND DISCUSSION

The following results clarify the effect of rains or excessive use of water on the soil treated with insecticides chlorpyrifos, fipronil and cypermethrin at different types of soil particle sizes or leaching into water table under ground.

I. Chlorpyrifos behavior in treated soil:

As shown in Table (3), showed that, at particle size 850µm complete mortality was obtained after 6 days (10-40cm depth). Mortality percentages were 93, 92, 91, 67, 47, and 31% at the seventh day at 50, 60, 70, 80, 90 and 100cm depth, the efficiency of chlorpyrifos in soil and its complete mortality within the upper 40cm of treated soil.

Table (3): Mortality percentages of *P. hypostoma* workers exposed to Chlorpyrifos 48% EC, at three different particle sizes within 7 days.

Particle size	Depth in cm	Mortality% in days							Cont.%
		1 day	2 days	3 days	4 days	5 days	6 days	7 days	
850 µm	10	79	88	95	98	99	100	100	2
	20	71	85	93	97	99	100	100	0
	30	74	83	89	94	97	99	100	2
	40	53	73	82	92	98	100	100	2
	50	52	63	75	82	88	92	93	1
	60	47	59	71	81	88	91	92	3
	70	38	52	61	73	81	90	91	0
	80	33	42	50	58	62	65	67	1
	90	21	28	32	37	43	46	47	4
	100	13	16	22	26	28	30	31	4
425 µm	10	87	95	97	100	100	100	100	0
	20	83	92	96	98	100	100	100	2
	30	73	83	92	95	98	100	100	0
	40	54	72	83	92	97	100	100	2
	50	56	71	82	88	94	97	98	3
	60	45	62	71	77	83	85	85	0
	70	45	61	70	79	83	84	85	2
	80	38	57	63	67	71	72	72	0
	90	21	31	36	40	43	44	44	1
	100	6	10	14	15	17	17	17	0
250 µm	10	87	94	98	100	100	100	100	1
	20	76	87	95	99	100	100	100	3
	30	69	84	91	96	98	100	100	0
	40	62	77	86	90	95	98	100	0
	50	56	72	84	93	97	97	97	١
	60	51	71	82	88	93	94	94	0
	70	36	50	58	66	69	74	74	2
	80	18	30	36	39	42	45	45	0
	90	8	11	16	17	20	21	21	3
	100	7	13	15	18	18	18	18	0

At 425µm sizes, 100% mortality were after 4 days (10cm depth) 5, 6 and 6 days (at 20, 30 and 40cm depth). While was ranged from 98% to 17% between depths of 50 to 100cm. At 250µm complete mortality were at 10, 20, 30, and

40cm depth represented fourth, fifth, sixth and seventh days of exposure. While fluctuated between 97 and 18% in the seventh days at depth from 50 to 100cm. Chlorpyrifos seems to be very toxic at the first soil layers (0-40cm) and gradually decreases downwards. Mortality% in control recorded at more 4% for the three tested soil particle sizes.

Singh *et al* (2000), in India, reported that, Chlorpyrifos, gave the movement of pesticide graded as follow: sandy loam, loam and salty loam soils when the organic matter washing and removal from the soils increased the movement of insecticides and same effect.

Mustafa (1975), mentioned that the movement of dursban are differed depending on the concentration and soil type. The highest of concentration found more downward movement. However, the author reported that dursban amount detected in the soil depth ranged from (20 – 25cm depth) in loamy sand soil. Residues of dursban were decreased gradually from the first layer and found the least quantities in the layer from 15 - 20cm. depth in loamy sand soil.

Data are agree with those of Pike *et al* (1981), who mentioned that, the residues of Chlorpyrifos was found in the top 2.5cm and the vertical movement in the irrigation soil was at least more than 99%.

Also, data are corresponding with Ghoniem (1979), resulted that, loam soil was more adsorption of insecticide allowed by calcareous and sandy loam, also dursban was less adsorption than other tested insecticides and the adsorption degree is increased by increasing of organic matters.

II. Fipronil behavior in treated soil:

Data in Tables (4), show the fipronil behavior in different particle size of soils. At 850µm size, complete mortality was obtained after one day of application at 10cm depth. After three, six and five days complete mortality were obtained at the depths of (20 and 30), (40 and 50cm). While mortality efficiency were 96, 84, 48,14, and 8% at depth of 60, 70, 80, 90, and 100cm respectively. At 425µm particle size complete mortality was recorded at the first day of application at 10 and 20cm depth. And reached 100% at 4, 6 and 5 days at depths of 30, 40 and 50cm.While less mortality at 68, 39, 17, 9 and 0 % were obtained at 60, 70, 80, 90, and 100cm depth. At 250µm particle size complete mortality (100 %), were recorded in the first day at 10 and 20cm. soil depth and the mortality complete at the third and fifth of 30 and 40cm. soil depth, and were 94, 58, 38, 21, 1 and 1 % at the depth of 50, 60, 70, 80, 90, and 100cm.

From the pre-mentioned data it is clear that in the bottom layers the bigger particle size, the higher efficiency of fipronil and vise versa. Fipronil has high toxicity extended from 10 to 60cm depth at 850 and 10-50 in particle size 425µm size. While at 250µm size the behavior was higher efficiency in surface layers extended from 10 to 40cm. depth. And apparently has no toxicity at the layer from 90- 100cm. On the other hand, data show high efficacy during the first day of application. Mortality percentages in control counted at more 2% for the three tested soil particle sizes.

Data are agreement with Ahmed (2003), concluded that, Termidor 5% could be considered more effective at 50cm depth where the mortality

percentages reached 100% at the 6 days earlier than those the other depths and the periods.

Table (4): Mortality percentages of *P. hypostoma* workers exposed to fipronil 5% EC, at three different particle sizes within 7 days.

Particle size	Depth in cm	Mortality% in Days							Cont.%
		1 day	2 days	3 days	4 days	5 days	6 days	7 days	
850 µm	**10**	100	100	100	100	100	100	100	0
	20	95	99	100	100	100	100	100	0
	30	96	99	100	100	100	100	100	0
	40	83	90	94	97	99	100	100	0
	50	67	79	89	98	100	100	100	1
	60	67	82	89	94	96	96	96	0
	70	56	67	78	83	84	84	84	0
	80	28	34	42	46	48	48	48	0
	90	5	6	13	14	14	14	14	1
	100	6	8	8	8	8	8	8	0
425 µm	**10**	100	100	100	100	100	100	100	0
	20	100	100	100	100	100	100	100	0
	30	90	96	99	100	100	100	100	0
	40	76	86	94	97	99	100	100	0
	50	54	68	78	84	100	100	100	1
	60	46	60	66	68	68	68	68	2
	70	25	30	36	39	39	39	39	0
	80	12	15	17	17	17	17	17	0
	90	4	7	9	9	9	9	9	0
	100	0	0	0	0	0	0	0	0
250 µm	**10**	100	100	100	100	100	100	100	0
	20	100	100	100	100	100	100	100	0
	30	94	98	100	100	100	100	100	1
	40	85	92	97	99	100	100	100	0
	50	49	65	71	73	94	94	94	2
	60	39	48	53	57	58	58	58	0
	70	24	42	35	38	38	38	38	0
	80	9	15	20	21	21	21	21	1
	90	1	1	1	1	1	1	1	0
	100	1	1	1	1	1	1	1	0

III. Cypermethrin behavior in treated soil:

Data presented in Tables (5), show the behavior of cypermethrin and its vertical movements downwards.

At a soil particle size 850µm, 100% mortality was obtained after three and four days of exposure, at 20,30 and 40cm depth and after 6 and 7 days at 60 and 70cm depth, respectively, while, mortality percentages were 79, 72, 26 and 21% in the seventh day at depth of 70, 80, 90 and 100cm, respectively. At 425µm particle size, complete mortality were recorded in the second, third, fourth and sixth day of exposure at depth of 10, 20, 30 and 40cm. The highest mortality was 97 and 96 % at 50 and 60cm depth. While the lowest mortality (37 and 15 %) was occurred at 90 and 100cm depth. At 250µm particle size, mortality was 100% in the first third and fourth day at depth of 10, 20, and 30cm respectively. And fluctuated from 97, 85 to 81% at the fifth, sixth and

forth day in depth of 40, 50, and 60cm, respectively. While the lowest one (7%) was noticed at 100cm depth.

Table (5): Mortality percentages of *P. hypostoma* workers exposed to cypermethrin 10% EC, at three different particle sizes within 7 days.

Particle size	Depth in cm	Mortality% in Days							Cont.%
		1 day	2 days	3 days	4 days	5 days	6 days	7 days	
850 µm	**10**	94	99	100	100	100	100	100	1
	20	91	98	99	100	100	100	100	0
	30	88	95	98	100	100	100	100	0
	40	75	91	98	100	100	100	100	0
	50	70	84	92	97	99	100	100	1
	60	56	79	87	95	99	100	100	2
	70	50	67	75	77	78	79	79	1
	80	36	51	57	65	69	71	72	0
	90	12	18	23	25	26	26	26	1
	100	11	17	20	21	21	21	21	0
425 µm	**10**	96	100	100	100	100	100	100	1
	20	94	96	100	100	100	100	100	0
	30	87	93	98	100	100	100	100	0
	40	66	80	88	93	97	100	100	0
	50	66	76	81	91	94	96	97	0
	60	52	71	81	88	92	96	96	2
	70	61	72	80	83	85	85	85	1
	80	38	59	67	72	74	78	79	0
	90	11	22	28	32	36	37	37	0
	100	5	13	13	15	15	15	15	1
250 µm	**10**	100	100	100	100	100	100	100	0
	20	91	96	100	100	100	100	100	1
	30	91	96	99	100	100	100	100	1
	40	78	88	92	95	97	97	97	0
	50	63	75	77	80	83	85	85	0
	60	56	61	72	81	81	81	81	0
	70	50	54	59	62	64	64	64	0
	80	36	38	47	49	50	52	52	2
	90	12	18	20	20	21	21	21	0
	100	6	7	7	7	7	7	7	1

According to such results, cypermethrin after 7 days of treatment moved downward to 60cm and gave mortality 100% when applied at a soil contains particle size more than 850µm particle size. and gave complete mortality up to 40cm depth when applied in soil particles measured 425µm, while reached to 30cm in soil contains particle less than 250µm. The least mortality was reached to the depth between 90-100cm; (26-21%), in particle size 850µm; (37-15%), in particle size 425µm; and (21-7%), in particle size 250µm, respectively. Mortality% in control recorded 2% at more for all tested soil particle sizes

Tasamouh *et al* (1983), studied the residues in sandy loam soil of chlorpyrifos. It was only 13.3% after 16 weeks at 1 ppm, while it was 20.7% and 21.3 at 10 and 100 ppm respectively. Chlorpyrifos extracted from the treated soil.

The author tested toxicity of some organic insecticides against termites *Psammotermes hypostoma* in laboratory. Data showed that the best orders of efficacy for 16 tested insecticides by the applied doses in downward graded as follow: dieldrin, heptinophos, fenvalerate, fenitrothion, primiphose methyl, profenophos, cypermethrin, monocrotophos, chlordane, permethrin, teriazophos, mephospholan, methomyl, diflopenzuron, tetrachlorovenphos and azodrin. The number of termites dead or moribund evaluated after 24 hr. LD_{50} was estimated from each concentration mortality regression lines.

Data are agree with Abdel-Wahab (1985), mentioned that, the pyrethroids compounds were the most effective ones, followed by chlorinated hydrocarbons and then carbamate and organophosphorus compounds, against *Amitermes desertorum* in the lab.

Data tabulated in Table (6), show that, chlorpyrifos gave complete mortality in treated soil ranged between 10-40cm at all tested particle size. Fipronil gave 100% mortality at a layer from 10-50cm in particle size 850 and 425µm, while at 250µm decreased to 10-40cm depths. Cypermethrin gave complete mortality till 60cm at particle size 850µm and at 425 and 250µm gave the same mortality at 40cm depth.

Table (6): Compared differences in the efficiency of three different groups of chemicals against *P. hypostoma* workers relatively to different particle size and depth of soil layers.

Particle size	Depth in cm	Mortality% after 7 days		
		Chlorpyrifos	Fipronil	Cypermethrin
850 µm	10	100	100	100
	20	100	100	100
	30	100	100	100
	40	100	100	100
	50	93	100	100
	60	92	96	100
	70	91	94	79
	80	67	48	72
	90	47	14	26
	100	31	8	21
425 µm	10	100	100	100
	20	100	100	100
	30	100	100	100
	40	100	100	100
	50	98	100	97
	60	85	68	96
	70	84	39	85
	80	72	17	79
	90	44	9	37
	100	17	0	15
250 µm	10	100	100	100
	20	100	100	100
	30	100	100	100
	40	98	100	97
	50	97	94	85
	60	94	58	81
	70	74	38	81
	80	45	21	64
	90	21	1	52
	100	20	1	21

IV. Chemical determination of tested insecticides residues in treated soil samples:

Depending on GLC analysis, the results of soil samples representing residues of the three insecticides moved downward into the depth of treated soil.

Data in table (7) show the ppm contents of each chemical through each particle size of soil. the results of soil samples analysis contained the tested chemicals in ppm at soil size 850µm. Soil treated with concentration of chlorpyrifos kept its highly doses (908ppm) at the first 10cm upper soil level and 60ppm till 40cm depth then decreased to 10ppm at 100cm depth. Fipronil reached a high concentration of 2756.8ppm at the soil surface, then fluctuated between 81.8 and 834ppm at 20 and 90cm depth and recorded the highest concentration 2847ppm at 100cm depth. Cypermethrin reached to 1182ppm at the soil surface, 2063ppm at 40cm and decreased all the depth distance.

In soil particle size 425µm, chlorpyrifos reached to 43ppm at 20cm depth and decreased within the all depth of soil. Fipronil contained 1072ppm at the surface and increased to 1595ppm at 50cm and then decreased to 62ppm at 100cm depth. Cypermethrin was 4799ppm at surface of soil, and 1176ppm at 60cm depth, then decreased to 392 ppm at 100cm.

At 250µm size, chlorpyrifos have its highest concentration (256ppm) at the surface and decreased all the rest of depth to 12ppm. Concentration of fipronil was 533ppm at 10cm and increased to 1293ppm at 20cm then decreased to 17ppm at 100cm depth. Cypermethrin, was 141 ppm at surface soil, then increased to 490 at 20-30cm and reduced to 55ppm at 100cm depth.

Generally, at particle size of 850µm, chlorpyrifos gave highly ppm contents at 10cm depth and decreased at all the rest of depth levels. Fipronil, showed high content of concentration values in the 10cm at surface and bottom and with moderate toxicity in med layers. It showed that it may migrate to the lower levels. Soil treated with cypermethrin showed high contents of ppm more than 1000ppm from surface to 30cm depth and increased more in the median layers then decreased at the distance of 100cm depth. At particle size 425µm chlorpyrifos, increased in toxicity within 20cm of upper layer and then reduced to all followed depth as in 850µm size Fipronil, increased within 30-50cm depths more than the upper and lower layers. Cypermethrin was more toxic within 40cm and decreased at the lower layers. At particle size 250µm, chlorpyrifos gave the same behavior of the two particle sizes of 850 and 425µm. Fipronil showed high concentration at surface layers 10-20 cm depth, and then decreased in bottom layers. Cypermethrin was low concentrate at upper layer and increased within 20-60cm, then reduced its ppm at the lower layer.

From the previously data it could be concluded that, the three tested insecticides were more toxic in sub-surface layers of treated soil with the coarse soil but the treated fine soil were more safety toxicity to the ground water. Fipronil showed to be the highest toxic one, followed by cypermethrin and chlorpyrifos, respectively, in spite of the cypermethrin showed to be the more toxic with coarse soil.

The soil analysis resulted that the chlorpyrifos was the more save for water table at all particle sizes followed by cypermethrin, while fipronil was the

lower safety one for water table, especially in soil particle sizes 580 and 425µm, respectively.

There for accordingly, It could be suggested that, the use of chlorpyrifos seem to be save for water table, due to its occupation the higher layer of soil. In contrary, fipronil gave high toxicity in all depths of treated soil and reached the lower layer of soil. That gives warning about water table. It can use at less doses to get more safe. Cypermethrin gave high toxicity at the med layer of treated soil, while was less toxic at the depth of 90cm and lower.

Table (7) : Values in ppm of chemical determination for tested insecticides residues in treated soils leached on the untreated soil column through different particle sizes as a long-tube.

Size/µm	Depth in cm	Insecticides residues values in ppm					
		Chlorpyrifos		Fipronil		Cypermethrin	
		Amount	Correct Value	Amount	Correct Value	Amount	Correct Value
850µm	10	854.3	908.8	2281.3	2756.8	1052.0	1182.0
	20	54.2	57.7	690.2	834.0	1106.0	1242.7
	30	20.9	22.3	101.3	122.4	942.5	1058.9
	40	58.36	62.085	363.5	439.274	1836.5	2063.5
	50	8.5	9.0	104.8	126.7	430.0	483.1
	60	0.9	0.9	364.1	440	229.0	257.3
	70	1.5	1.6	199.3	240.8	199.5	224.2
	80	6.8	7.3	541.3	654.1	90.5	101.7
	90	6.9	7.4	67.8	81.8	122.5	137.6
	100	9.5	10.1	2356.5	2847.7	125.0	140.4
425µm	10	14.2	15.1	887.0	1071.9	4271.5	4799.3
	20	41.1	43.7	556.1	671.9	2598.5	2919.6
	30	2.1	2.1	105.4	127.4	1739.0	1953.9
	40	3.5	3.8	967.7	1169.4	1029.0	1156.1
	50	0.7	0.7	1320.0	1595.1	1103.5	1239.8
	60	1.1	1.2	36.0	43.5	1047.5	1176.9
	70	0.3	0.3	84.5	102.1	363.5	408.4
	80	2.6	2.7	60.0	72.5	105.0	117.9
	90	4.6	4.9	98.25	118.7	325.0	365.1
	100	1.4	1.5	51.8	62.5	349.0	392.1
250µm	10	241.4	256.8	441.4	533.4	125.5	141.0
	20	29.5	31.3	1075.3	1299.4	429.0	482.0
	30	1.3	1.4	157.3	211.9	444.0	498.8
	40	1.0	1.1	191.4	231.3	238.2	267.6
	50	1.2	1.3	45.7	55.2	190.5	214.0
	60	1.3	1.4	53.1	64.1	263.0	295.5
	70	15.7	16.7	57.7	69.7	56.3	63.2
	80	0.4	0.4	14.1	17.0	463.0	52.2
	90	0.5	0.6	13.8	16.6	23.5	26.4
	100	11.9	12.6	109.2	131.9	49.3	55.4

V. Statistics analysis:

Data in table (8), clarified that, the mean of treatments for chlorpyrifos, fipronil and cypermethrin, were 79.000, 66.867 and 79.600 respectively, and found significantly differences (F. value 13.29). Also the means of particle sizes were 79.300, 74.733 and 71.433 for particle size 850, 425 and 250µm

respectively, and F. value recorded significantly 4.02. The mean's depths were 100, 100, 100, 99.4, 96, 85.556, 73.889, 53.889, 27.889 and 14.889 for depths 10,20, 30, 40, 50, 60, 70, 80, 90 and 100cm respectively, and F. value recorded significantly 79.8.

Table (8): Illustration of significantly variables between the tested factors, insecticides, particle sizes and depths with the variable factor (mortality%).

Mean of treatments										**F. Value**	**Pr > F**
Chlorpyrifos				**Fipronil**			**Cypermethrin**				
79.000				66.867			79.600			13.29*	0.0219
Mean of particle sizes											
850µm				**425µm**			**250µm**				
79.300				74.733			71.433			4.02**	0.0001
Mean of depths in cm											
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**		
100	100	100	99.4	96	85.556	73.889	53.889	27.889	14.889	79.8**	0.0001

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التقييم المعملى لبعض المبيدات ضد النمل الأبيض التحت أرضى فى طبقات التربة وعلاقتها بمستوى الماء الارضى

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أثبتت دراسة معاملات التربة ضد النمل الأبيض ساموتيرمس هيبوستوما أن مجموعة المبيدات الثلاث المختبرة (الكلوربيريفوس والفبرونيل والسيبرميثرين) كانت أكثر سمية فى طبقات التربة التحت سطحية عندما عوملت مع حجم حبيبات التربة الأكبر ولكن كانت أقل سمية عندما عوملت مع حجم حبيبات التربة الأقل حجم وكانت الأكثر أمانا لتلوث المياه الأرضية. وعند مقارنة سمية الثلاث مبيدات المختبرة كان مبيد الفبرونيل أكثر سمية ثم كان السيبرميثرين والكلوربيريفوس على التوالى رغم أن مبيد السيبرميثرين كان أكثر سمية مع حجم حبيبات التربة الأكبر. تحليل المتبقيات فى عينات التربة المختبرة أثبت أن مبيد الكلوربيريفوس كان الأكثر أمانا لتلوث المياه الأرضيه مع جميع أحجام التربة المختبرة ثم كان مبيد السيبرميثرين فى المرتبة الثانية أما مبيد الفبرونيل كان الأقل أمانا لتلوث المياه الأرضيه خاصة مع حجم حبيبات التربه ٨٥٠ و ٤٢٥ ميكرون على التوالى. التحليل الإحصائى أثبت أن هناك فروق معنوية بين العوامل المختبرة (المعاملات وحجم حبيبات التربة وأعماق لتربة.