

## EVALUATION OF THREE TERMITICIDES AGAINST SUBTERRANEAN TERMITE (SAND TERMITE), *Psammotermes hypostoma* (DESNAX)

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### ABSTRACT

Treatment with topical application showed that the pyrethroids group, (Cypermethrin) was the highest toxic against the subterranean termites *Psammotermes hypostoma* (Desn.) after 12 hr. where recorded (LD<sub>50</sub> value = 0.056001 and LD<sub>90</sub> reached to 0.59557 µg/worker), followed by chlorpyrifos, recorded (LD<sub>50</sub> value = 0.08066 and LD<sub>90</sub> reached to 0.42698 µg/worker), and fipronil was in the last rank where recorded (LD<sub>50</sub> value = 0.089141 and LD<sub>90</sub> reached to 1.33442 µg/worker). Data after 24 hr. indicated again that, cypermethrin in the first rank in the acute toxicity, while fipronil come in the next rank followed by chlorpyrifos (LD<sub>50</sub> value recorded 0.02265, 0.026085 and 0.0393 µg/worker respectively), and the values of LD<sub>90</sub> reached 0.10035, 0.1054 and 0.15748 µg/worker, respectively. At all times control recorded 2, 2 and 4 % for chlorpyrifos, fipronil and cypermethrin, respectively.

### INTRODUCTION

Subterranean or Sand termite, *Psammotermes hypostoma* (Desn.), one of most distributed termite all over Egypt, causing damage to many materials containing cellulose, such as wood, papers, clothes, trees, and woody tissues of plants, buildings constructional timbers, agricultural crops, books, and stored products. In order to evaluate certain insecticide, soil type and soil particle size should be in consideration. The termite distribution is often depends on the soil and plant materials prevailing the country. The present work was conducted to evaluate three groups of insecticides such as chlorpyrifos, fipronil and pyrethroids against *P. hypostoma* (Desn.), at laboratory.

### MATERIALS AND METHODS

#### Insect collection:

The subterranean termites, *Psammotermes hypostoma* (Desn.) were collected from Ismailia Regional, Agriculture Research Station, using El-Sebay modified trap (El-Sebay 1991). Termites were separated from the traps by air bump respirator and kept in Petri-dishes provided with pieces of moistened card boards as a source of cellulose and moisture required for termites for seven days in incubator adjusted at 27C° ±1C°. Daily inspection was carried out and eliminated dead or moribund individuals. The healthy workers (5<sup>th</sup> and 6<sup>th</sup> instars) were implementation. (El-Sebay, 1993a and 1993b; El-Bassiouny, 2001).

### Experiment

A Stock solution of 1000ppm was prepared from active ingredient (technical grade) of the three tested termiticides. Serial dilutions from each insecticide was prepared 0.25, 0.125, 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg . Five replicates form each concentration and 10 tested healthy termites were adopted for each replicate. Termites were torpor by the exposure to formalin for 30 second and then were treated by using 1µL from each conc. on the thorax region by hand microapplicator (Burkard scientific). Five replicates of control treated with acetone solvent were compared with each conc. The treated termites and control were placed in Petri dish in each replicate and provided with moistened cardboard and kept inside incubator adjusted at (27°C ±1). Mortality estimated after 12 and 24 hr. LD<sub>50</sub>, LD<sub>90</sub>, Upper and lower confidence limits for both were calculated using probit analysis according to Finney (1971), and the toxicity index were calculated according to Sun formula, Sun (1950). Ldp Line computer program were used in data analysis.

### Tested insecticides:

- 1- Organophosphates group was represented by chlorpyrifos: O,O-diethyl O-3,5,6-trichloro-2-pyridyl phosphorothioate (Dursban.48 % EC).
- 2- Fiprol or phenylpyrazole group was represented by Termidor: (±)-5-amino-1-(2,6-dichloro-α,α,α-trifluoro-*p*-tolyl)-4-trifluoromethylsulfanylpyrazole-3-carbonitrile as Termidor 5% EC.
- 3-Pyrethroids was represented by cypermethrin: (RS)-α-cyano-3-phenoxybenzyl (1RS,3RS; 1RS,3SR)-3-(2,2-dichlorovinyl)-2,2-dimethylcycloprop- anecarboxylate Roth: (RS)-α-cyano-3-phenoxybenzyl (1RS)-*cis-trans*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclo propanecarboxylate as Actamethrin 10% EC.

## RESULTS AND DISCUSSIONS

Data in Table (1), showed that, chlorpyrifos after 12 hours caused different percent mortality against *P. hypostoma* workers of 84, 64, 40, 20, 16, 6 and 2% at doses of 0.25, 0.125, 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker, respectively. Chlorpyrifos gave complete mortality (100%) after 24 hours at dose of 0.25 µg followed by 90% at 0.125 µg/worker. While gave mortality of 64, 38, 24, 8 and 4% at doses of 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker.

As shown in Table (2), fipronil gave 68, 54, 50, 34, 22, 12 and 2% mortality after 12 hours at 0.25, 0.125, 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker, respectively. After 24 hours data in table showed that, fipronil gave 100% mortality at 0.25 µg/worker, and 96% at 0.125 µg/worker. While gave 74, 58, 34, 14 and 6% mortality at 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker, respectively.

Data in Table (3), showed that at 12 hours the cypermethrin gave mortality of workers 78, 72, 54, 34, 32, 20 and 8% at doses of 0.25, 0.125, 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker, while at 24 hours, the cypermethrin complete mortality at dose of 0.25 µg/worker followed by

98% at 0.125 µg/worker. The followed mortality percentages were; 82, 62, 44, 20, and 8 % at doses of 0.0625, 0.03125, 0.01562, 0.00781 and 0.0034 µg/worker, respectively.

The presented data in Tables (4 and 5) and Figs. (1 and 2), showed that cypermethrin proved to be the most effective one of the tested insecticides against the subterranean termites *Psammotermes hypostoma* (Desn.) after 12 hr. followed by chlorpyrifos and fipronil, showing the LD<sub>50</sub> values of 0.056001, 0.08066 and 0.0891412 µg/worker, respectively. However LD<sub>90</sub> reached 0.59557, 0.42698 and 1.33442 µg/worker, respectively. The toxicity index being 69.42 and 62.82 % for chlorpyrifos and fipronil (Based on LD<sub>50</sub> of cypermethrin 100.0 %) respectively. In relation to the acute toxicity after 24 hr. from treatment with topical application technique, as well cypermethrin was the most effective tested insecticides gave LD<sub>50</sub> value of 0.02265 µg/worker. Whereas fipronil came in the next level followed by chlorpyrifos (0.026085 and 0.0393 µg/worker, respectively). The corresponding LD<sub>90</sub> reached 0.10035, 0.1054 and 0.15748 µg/worker, respectively. The toxicity index being 86.84 and 57.63 % for fipronil and chlorpyrifos (Based on LD<sub>50</sub> of cypermethrin 100.0 %) respectively. At all times the total average of mortality percentages in control recorded 2, 2 and 4 % for chlorpyrifos, fipronil and cypermethrin, respectively.

Generally, it could be suggested that, the cypermethrin and fipronil insecticides were the best as acute poisons and can used them in the highly attack of termites, and insecticides needed 24 hours to kill highly numbers of termites. Cypermethrin was the more toxic at 12 hr followed by chlorpyrifos and fipronil, respectively. At 24 hr the highest toxicity recorded cypermethrin, fipronil and chlorpyrifos respectively.

**Table (1): Mortality percentage of chlorpyrifos in ppm due to topical application treatment of *P. hypostoma* workers within 12 and 24 hours.**

Dose in ppm	Mortality													
	At 12 hr.					Total	%	At 24 hr.					Total	%
	Replicates							Replicates						
	1	2	3	4	5	1	2	3	4	5				
<b>0.25</b>	10	5	10	7	10	42	84	10	10	10	10	10	50	100
<b>0.125</b>	7	7	5	7	6	32	64	10	9	10	9	7	45	90
<b>0.0625</b>	3	ε	2	6	5	20	40	10	7	3	8	4	32	64
<b>0.0312</b>	2	2	4	2	0	10	20	4	5	4	2	4	19	38
<b>0.0156</b>	3	2	1	1	1	8	16	3	4	2	2	1	12	24
<b>0.0078</b>	1	1	0	0	1	3	6	2	1	0	0	1	4	8
<b>0.0034</b>	0	0	1	0	0	1	2	0	1	0	0	1	2	4
<b>Cont.</b>	1	0	0	0	0	1	2	1	0	0	0	0	1	2

Table (2): Mortality percentage of fipronil in ppm due to topical application treatment of *P. hypostoma* workers within 12 and 24 hours.

Dose in ppm	Mortality													
	At 12 hr.					Total	%	At 24 hr.					Total	%
	Replicates							Replicates						
	1	2	3	4	5	1	2	3	4	5				
0.25	8	7	6	5	8	34	68	10	10	10	10	10	50	100
0.125	5	7	6	5	4	27	54	10	9	10	10	9	48	96
0.0625	5	7	6	2	5	25	50	10	4	8	6	9	37	74
0.0312	5	2	5	5	0	17	34	7	2	6	4	10	29	58
0.0156	3	1	3	0	4	11	22	4	3	7	2	1	17	34
0.0078	2	2	0	2	0	6	12	1	2	2	1	1	7	14
0.0034	0	1	0	0	0	1	2	1	0	0	1	1	3	6
Cont.	1	0	0	0	0	1	2	1	0	0	0	0	1	2

Table (3): Mortality percentage of cypermethrin in ppm due to topical application treatment of *P. hypostoma* workers within 12 and 24 hours.

Dose in ppm	Mortality													
	At 12 hr.					Total	%	At 24 hr.					Total	%
	Replicates							Replicates						
	1	2	3	4	5	1	2	3	4	5				
0.25	6	9	7	7	10	39	78	10	10	10	10	10	50	100
0.125	6	7	7	8	8	36	72	10	10	9	10	10	49	98
0.0625	5	6	7	4	5	27	54	7	8	10	6	10	41	82
0.0312	3	5	2	5	2	17	34	9	5	3	6	8	31	62
0.0156	5	4	2	4	1	16	32	4	8	4	2	4	22	44
0.0078	3	2	0	4	1	10	20	3	0	3	4	0	10	20
0.0034	2	0	0	1	1	4	8	1	1	0	2	0	4	8
Cont.	2	0	0	0	0	2	4	2	0	0	0	0	2	4

Data are in agreement with that obtained by Chavewan and Charles (1974), Khoo and Martin (1979). Data are in agreement with that obtained by Nan-Yao Su and Rudolef (1990), they reported that, the deltamethrin was most toxic for *C. formosanus* and *P. flavipes* (LD<sub>50</sub> 0.12 and 0.01ug/g) while chlordane was least toxic (LD<sub>50</sub> 45.34 and 20.1ug/g). They added that, the termite *P. flavipes* was more susceptible to all termiticides than *R. flavipes* and *C. formosanus*. Ibrahim *et al* (2003), mentioned that, the toxicity of fipronil against *C. formosanus* Shiraki, by topical application assays, was highly effective against both workers and soldiers at very low doses. Acute toxicity after 24 hr was significantly greater in workers than in soldiers. The LD<sub>50</sub>S values were 2.59- and 2.91-fold greater with soldiers than with workers from the two tested colonies.

Table (4): The relative susceptibility of the subterranean termites *P. hypostoma* to three tested groups of insecticides after 12 hr. from treatment with topical application technique.

Tested insecticides	After 12 hr.				Slope	Toxicity index %
	LD <sub>50</sub> (µg) Its limits at 95%		LD <sub>90</sub> (µg) Its limits at 95%			
Chlorpyrifos	0.08066		0.42698		1.771 ± 0.191	69.42
	0.06491	0.10311	0.28725	0.76264		
Cypermethrin	0.056001		0.59557		1.248 ± 0.135	100
	0.04266	0.07609	0.34741	1.32199		
Fipronil	0.089141		1.33442		1.091 ± 0.159	62.82
	0.0642	0.13648	0.61305	5.18026		

Toxicity index = LD<sub>50</sub> of the most effective insecticide / LD<sub>50</sub> of the tested insecticides x 100 (Sun 1950)

Table (5): The relative susceptibility of the subterranean termites *P. hypostoma* to three tested groups of insecticides after 24 hr. from treatment with topical application technique.

Tested insecticides	After 24 hr.				Slope	Toxicity index %
	LD <sub>50</sub> (µg) Its limits at 95%		LD <sub>90</sub> (µg) Its limits at 95%			
Chlorpyrifos	0.0393		0.15748		2.126 ± 0.218	57.628
	0.03248	0.04833	0.11469	0.24684		
Cypermethrin	0.02265		0.10035		1.983 ± 0.206	100
	0.01845	0.02787	0.073091	0.15719		
Fipronil	0.026085		0.1054		2.113 ± 0.205	86.839
	0.02156	0.03165	0.07879	0.15672		

Toxicity index = LD<sub>50</sub> of the most effective insecticide / LD<sub>50</sub> of the tested insecticides x 100 (Sun 1950)

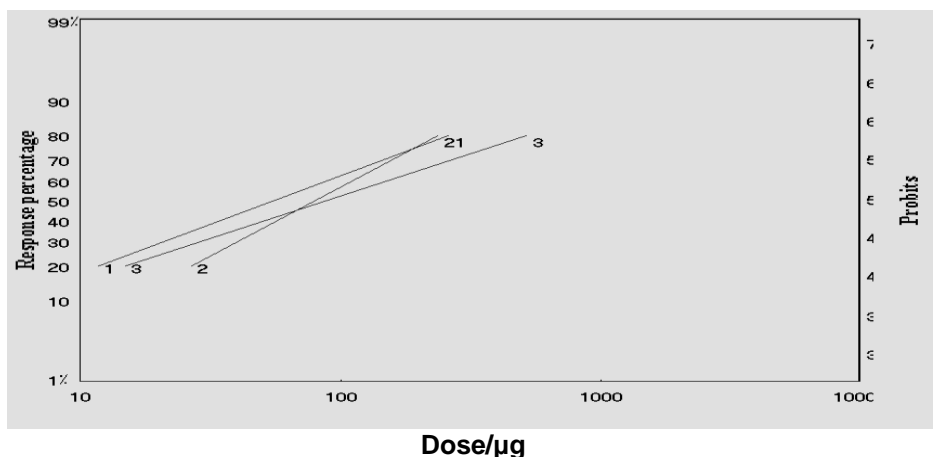


Fig. (1): Ldp lines of the three tested insecticides against the subterranean termite *P. hypostoma* (Desn.) after 12 hr. of treatment.

- (1). Cypermethrin.
- (2). Chlorpyrifos.
- (3). Fipronil.

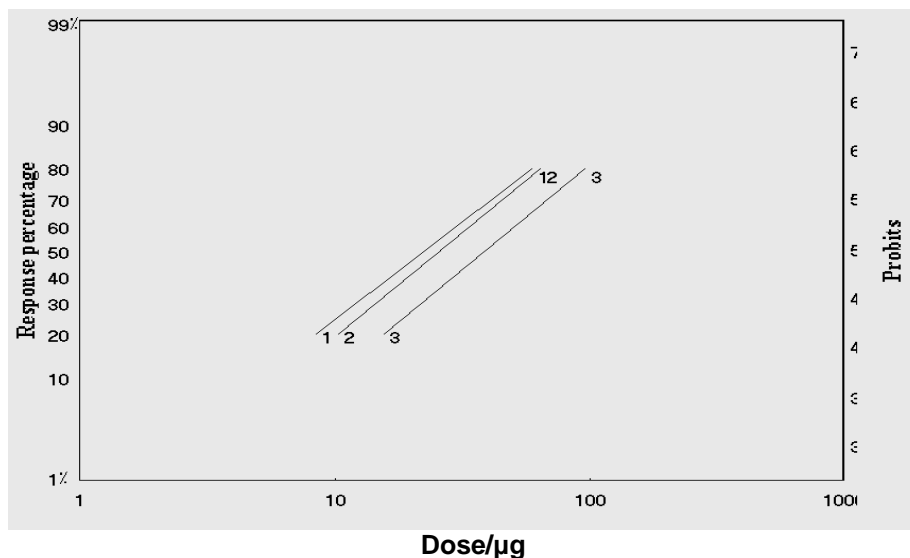


Fig. (2): Ld-p lines of the three tested insecticides against the subterranean termite *P. hypostoma* (Desn.) after 24 hr. of treatment.

- (1). Cypermethrin.
- (2). Fipronil.
- (3). Chlorpyrifos.

## REFERENCES

- Chavewan H. and O. K. Charles (1974): Toxicity and action of chloropyrophos and other organophosphates in the Eastern subterranean termite. Dept. Entomol. University of Missouri, Colombia 65201. J. Econ. Entomol., 67 (6): 721-727.
- El-Bassiouny A. R. (2001): A study on the ecology and biological control of subterranean termites M. Sc. Thesis, Fac. Agric. Al-Azhar University.
- El-Sebay Y. (1991): A modified trap for El-Sebay subterranean termites. Fourth Arab Cong. of Plant Protection.
- El-Sebay Y. (1993a): Ecological studies on the harvester termites *A. ochraceus* (Burm.) in Egypt. Assuit J. Agric. Sci., 24 (4): 35-47.
- El-Sebay Y. (1993b): Evaluation of soil treatment with certain insecticides for subterranean termite control. Bull. Entomol. Soc. Egypt. Econ. Ser. 20 (47): 47-58.
- Finney D. J. (1971): Probit analysis. A Statistical Treatment of the Sigmoid Response Curve. 7<sup>th</sup> Ed., Cambridge Univ. Press, England.
- Ibrahim S. A; G. Henderson and H. X. Fei (2003): Toxicity, repellency, and horizontal transmission of Fipronil in the Formosan subterranean termite (Isoptera: Rhinotermitidae) J. Econ. Entomol., 96 (2): 461-467.
- Khoo K. and S. Martin (1979): Toxicity of Chlorpyrophos to normal and defaunated Formosan subterranean termites. J. Econ. Entomol., 72 (2): 298-304.

Nan-Yao Su and H. S. Rudolef (1990): Comparison of eleven soil termiticides against the Formosan subterranean termite and Eastern subterranean termite (Isoptera: Rhinotermitidae).

Sun Y. P. (1950): Toxicity index an improved method of comparing the relative toxicity of insecticides. J. Econ. Entomol., 43: 45-53.

### تقييم السمية الحادة لبعض مبيدات التربة ضد النمل الأبيض التحت أرضى أو نمل الرمال "ساموترمس هيبوستوما"

يسرى محمد عبد المنعم السباعي<sup>١</sup>، سلوى السعيد نجم<sup>٢</sup>، على على عبد الهادي سعيد<sup>٣</sup>  
أيمن رمضان البسيوني<sup>٤</sup>

1- قسم بحوث ناخرات الأخشاب والنمل الأبيض - معهد بحوث وقاية النباتات.

2- قسم المبيدات - كلية الزراعة - جامعة المنصورة.

في دراسة المعاملة الموضوعية أثبتت النتائج أن مجموعة مبيدات البيريثرينات (السيبرميثرين) أعطى أعلى فعالية ضد آفة النمل الأبيض *Psammotermes hypostoma* (Desn.) بعد 12 ساعة حيث سجلت الجرعة النصفية المميتة لـ ٥٠% من الحشرات المختبرة 0.056001 ميكروجرام لكل شغالة وكانت الجرعة المميتة لـ ٩٠% من الحشرات المختبرة 0.59557 ميكروجرام لكل شغالة ثم كانت مجموعة المركبات الفوسفورية العضوية (الكلوربيريفوس) في المرتبة الثانية حيث سجلت الجرعة المميتة لـ ٥٠% من الحشرات المختبرة 0.08066 ميكروجرام لكل شغالة وكانت الجرعة المميتة لـ ٩٠% من الحشرات المختبرة 0.42698 ميكروجرام لكل شغالة لكن مجموعة مركبات الفينيل بيرازول (مبيد الفبرونيل) كان في المرتبة الأخيرة حيث سجلت الجرعة المميتة لـ ٥٠% من الحشرات المختبرة 0.089141 ميكروجرام لكل شغالة وكانت الجرعة المميتة لـ ٩٠% من الحشرات المختبرة 1.33442 ميكروجرام لكل شغالة. كما بينت النتائج أن مبيد السيبرميثرين كان الأعلى سمية بعد ٢٤ ساعة من المعاملة حيث سجلت النتائج أن الجرعة النصفية المميتة لـ ٥٠% من الحشرات المختبرة 0.02265، 0.026085، 0.0393 ميكروجرام لكل شغالة وكانت الجرعة المميتة لـ ٩٠% من الحشرات المختبرة 0.10035، 0.1054، 0.15748 ميكروجرام لكل شغالة لمبيد السيبرميثرين والفبرونيل والكلوربيريفوس على التوالي. وسجلت نسبة الموت في الكنترول ٢، ٢، ٤، لكل من مبيد الكلوربيريفوس والفبرونيل و السيبرميثرين على التوالي.