EFFICACY OF SOME INORGANIC SALTS AGAINST THE DRY-WOOD TERMITE CRYPTOTERMES BREVIS WALKER .

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Abstract

Effects of the inorganic salts, copper sulphate, sodium fluoride and borax were studied against nymphs of the dry-wood termite Cryptotermes brevis Walker. After 2 days of treatment, mortalities were 8.33, 6.67 and 0.00% at 0.5% copper sulphate, sodium fluoride and borax, respectively. The corresponding figures were 68.89, 43.33 and 26.67, respectively with the highest concentration (5%). The longest period of exposure (28 days) induced 83.33, 100 and 72.22% mortality at 0.5% concentration of the tested compounds, respectively.

INTRODUCTION

The termite Cryptotermes brevis (Walker) is a serious pest of the dry-wood and wooden products in Egypt. Protection of wood and wooden products to bio-deterioration has been developing grown worldwide. Extensive uses of organic chemical pesticides cause hazardous effects to the environment and development of resistant insect strains, thereby have led to use other alternative controls. Recently, several studies indicate effects of inorganic salts to the termites (Chen *et al.* 1986 Roomi *et al.* 1990; Su and Sheffrahn 1991 and Grace *et al.* 1993). These salts consider as slow acting toxic materials and non-repellent, while organic pesticides are repellent compounds (Rust and Smith, 1993). The goal of this research is to study the toxic effects of three inorganic salts, copper sulphate, sodium fluoride and borax to nymphs of C.brevis.

MATERIALS AND METHODS

1. Chemicals

Copper sulphate, ($CuSO_4 . 5H_2O$), sodium fluoride (NaF) and borax, di-sodium

tetra-borate, ($Na_2B_4O_7$. $10H_2O$).

2. The termite

The nymphs used in the experiment were obtained from standard colony maintained at 27±1°C and 75±1% RH on wooden chips of Picea sp. at the Laboratory of Termite Research, Agricultural Research Station of Sabahia, Alexandria. At least the fourth nymphal instar was used in the tests.

3. Laboratory tests

Blocks of sap wood Picea sp. (3x2x0.5 cm) were impregnated with the tested concentrations : 0.5, 0.75, 1.0, 2.5 and 5.0% (w/v) diluted in water. The blocks treated with water considered as controls. Each treatment was replicated 6 times. After dryness, each block was exposed to 10 nymphs into a perti dish. The tests were incubated in a dark cabinet at 27±1°C and 75 ± 1% RH. Mortalities were counted at 2, 5, 7, 14, 21 and 28 days post-treatment and corrected using Abbott's formula (Abbott, 1925). Data were subjected to analysis of variance (ANOVA) and means were compared by L.S.D. test at 0.05 level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data in Table 1 showed the toxic effects of copper sulphate, sodium fluoride and borax against C.brevis nymphs. In case of copper sulphate, the concentration 0.5% gave 8.33% mortality after 2 days and increased to 83.33% after 28 days. The highest concentration 5% induced 68.89 and 100% mortality after 2 and 21 days, respectively. Significant differences were obtained among the concentrations and days after exposure. In this one respect, Chen *et al.* (1986) stated that the toxic dosages of copper compound prevent feeding of termites on treated wood, and protect the nearby untreated wood, whereas organic pesticides are almost repellent.

Concerning sodium fluoride, two days after exposure to 0.5 and 5% concentrations caused 6.67 and 43.33% mortality, respectively. Also, these concentrations gave 38.89 and 100% mortality after 14 days. The tested concentrations induced 100% mortality after 21 days, except the concentration 0.5% showed 88.89% mortality. These results agree with those obtained by Kerner and Becker 1969, who reported that fluoride compounds gave the best control against the termites Kalotermes spp., Heterotermes spp., Reticulitermes spp. and Coptotermes spp.

The effect of fluoride salts is attributed to fluoride anions which inhibit activity of enzymes containing magnesium co-factor (Meike *et al.* 1963), resulting in cessation catabolism of lipid and glycolysis.

As shown in Table 1, borax was the least effective salt to C.brevis. After 2 days, the concentrations 0.5 and 5% caused 0.00 and 26.67% mortality, and increased to 72.22 and 100%, respectively after 28 days. Increasing concentrations induced the highest toxic effects with significant differences. Monsalud (1964) reported that 1% boric acid gave adequate protection to the termites, while 0.6% conc. was noneffective. Amburgey and Freeman (1993) demonstrated that the borax is converted to boric acid in wood and diffuse through cell walls of moist wood, whereas boric acid protected some timber kinds and chip-board effectively against several termite species (Gay *et al.*, 1958 and Pantua, 1965). However, Kerner and Becker (1969) indicated that boric acid was non-effective to the dry-wood termite.

The results indicated that copper sulphate was the most effective salt in comparison to sodium fluoride and borax, giving significant differences among the means of mortality 70.17, 61.21 and 43.01%, respectively. Salman and Sayed (1990) mentioned that 10% insecticidal barriers of copper sulphate or borax inhibited attack of the termite Psamotermes hypostoma Desneux for 6 and 12 months, respectively in Kharga, New Valley, Egypt.

Finally, the results showed that the toxic effects of these salts against C.brevis, depend on the concentrations and exposure period. Consequently, these chemicals may help to protect the wood and wooden products, thereby reduce the extensive uses of pesticides in the environment.

Table 1. The toxic effects of copper sulphate, sodium fluoride and borax to the termite C.brevis .

Treatment	Conc. (%)	Mortality (%) at mentioned days post-treatment						Means
		2	5	7	14	21	28	
Copper sulphate	0.50	8.33 f	10.32 ef	19.76 de	65.48 c	75.00bc	83.33ab	
	0.75	19.44 d	42.06 d	55.95 c	75.00 bc	83.33ab	100.00a	
	1.00	47.22 d	59.32 cd	73.81 bc	82.74 b	86.11a	100.00a	
	2.50	55.56 c	73.81 bc	82.74 b	86.90 ab	100.00a	----	
	5.00	68.89 c	82.74 b	91.67 ab	91.67 ab	100.00a	----	70.17 A
Sodium fluoride	0.50	6.67k	8.33 k	27.78 ghij	38.89 fgh	88.89ab	100.00a	
	0.75	15.00 jk	19.44 ijk	36.11 fgh	44.44 efg	100.00a	----	
	1.00	20.83 hij	31.94 fghi	55.56def	66.67 cd	100.00a	----	
	2.50	28.33 ghij	41.67 efgh	63.89 de	83.33 bc	100.00a	----	
	5.00	43.33 efg	45.83 efg	69.44 cd	100.00 a	----	----	61.21 B
Borax	0.50	0.00 o	6.67 mno	6.67 no	8.33 no	47.22fghij	72.22bcdef	
	0.75	0.00 o	10.00 lmno	15.00 klmn	16.67 klmn	55.65efghi	80.56bcde	
	1.00	6.67 no	16.67 klmn	21.67 jklmn	47.22fghij	75.00bcde	91.67abc	
	2.50	13.33 klmn	33.33 hijkl	35.00 hijk	61.11defgh	83.33abcd	93.83ab	
	5.00	26.67 ijklm	43.33ghij	56.67 efghi	72.22cdef	91.67abc	100.00a	43.01 C

Means followed by the same letter (for each compound at different days post-treatment) are not significantly different at 0.05 level by L.S.D. test.

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فعالية بعض الأملاح غير العضوية ضد النمل الأبيض التى تصيب الأخشاب الجافة (كريبتموترميس بريفيس)

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استهدف البحث دراسة فعالية بعض الأملاح غير العضوية مثل كبريتات النحاس، فلوريد الصوديوم والبوراكس ضد حوريات النمل الأبيض (كريبتوترميس بريفيس) عند تركيزات مختلفة وأيام معينة بعد المعاملة وذلك لإمكانية استخدام تلك المركبات فى مكافحة النمل الأبيض والتقليل من إستخدام المبيدات العضوية الكيماوية. ولقد أظهرت النتائج أن تركيز ٠,٥٪ لأملاح كبريتات النحاس ، فلوريد الصوديوم ، بوراكس أعطى نسبه مئويه للموت بلغت ٨,٣٣ ، ٦,٦٧ ، صفر ٪ على التوالى . بينما أعطت تلك النسب عند تركيز ٥٪ : ٦٣,٨٩ ، ٤٣,٣٣ ، ٣٦,٦٧٪ موت فى الحوريات على التوالى. وعند إطالة فترة التعريض إلى ٢٨ يوما بلغت نسبة الموت ٨٣,٣٣ ، ١٠٠ ، ٧٢,٢٢٪ عند تركيز ٠,٥٪ من كبريتات النحاس ، فلوريد الصوديوم ، البوراكس على التوالى.