

POTENTIAL EFFECTS OF SOIL TREATMENTS FOR THE CONTROL OF THE MOUND BUILDING TERMITE, *MICROCEROTERMES EUGNATHUS SILVESTRI* (ISOPTERA: TERMITIDAE) IN THE WEST-NORTHERN COAST OF EGYPT

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Abstract

Field trials were conducted in the west-northern coast to evaluate the efficacy of several chemicals against the subterranean termite, *Microcerotermes eugnathus* in areas of vine and acacia trees at Fouka village. In the first test, dragnet and cidal proved to be highly effective for one year in vine area. Dimilin, copper sulphate and borax showed significant efficacy depending on the concentration used. At 2% concentration, their efficacy reached 100, 97.47, 82.54, 86.68 and 81.23%, respectively. Also, chemicals in the second test indicated pronounced potency to this pest when applied under a concrete slab in comparison with uncovered treatments in vine area. Concentration 2% of cidal, sumicidin and cyanox induced 100, 99.39 and 98.36% protection for one year with a concrete slab method, in comparison to 97.47, 99.04 and 94.6% with uncovered trenches.

The third test demonstrated the highest effects of sodium fluoride, copper sulphate and borax at 5% concentration against *M. eugnathus* in acacia tree area, giving above 90% protection after one year.

INTRODUCTION

Protection against termites is necessary for structures and products made of wood. Recently, several control methods were used against termites such as chemical and microbial treatments, growth regulators and inorganic salts (Beal and Carter, 1968; Beal and Miller, 1980; Prestwich et al., 1983; Jones, 1984; Faragalla et al., 1985; Su and Scheffrahn, 1986; Grace, 1991).

In the west-northern coast, a new species of subterranean termites identified as a mound building termite, *Microcerotermes eugnathus* (Silvestri), showed considerable damage to some plant hosts as vine, acacia, sisso, athal and casuarina and for structures indoors (Moein, 1997). The trunk might be hollowed in one side with the severe infestation and the individuals were seen in muddy tubes over the bark.

The use of soil treatments to control subterranean termites is developed and different methods for termiticides evaluation were adopted by several investigators (Harris, 1965; Miller, 1980; Faragalla et al., 1985; Mauldin et al., 1987; Kard et al., 1989; Su, 1991). For efficient protection against the subterranean termites, treating the ground site beneath slab with toxic or repellent material is early recommended (Sorenson, 1955). Damage due to this pest may become more serious with further development of cultivations in the new reclaimed areas. Hence, efficient managing is important to suppress pest communities and damage potential to plants or nearby structures, providing long-term control.

This study was undertaken to determine the potential effects of several broad spectrum chemicals for controlling the subterranean termite, *M.eugnathus* in areas of vine and acacia at the west-northern coast of Egypt.

MATERIALS AND METHODS

Chemicals evaluated in the trials were the organophosphates (cidial 50% EC, cyanox 50% EC), the pyrethroids (dragnet 36.8% EC, sumicidin 20% EC), the insect growth regulator (dimilin 20% WP) and the inorganic salts (copper sulphate, borax, sodium fluoride).

The termite identified in the preliminary tests in the west-northern coast was *M.eugnathus* causing heavy infestations for vine, acacia, sisso, athal, casuarina with severe damage for wooden work in housing (Moein, 1997).

The field tests were conducted during December 1995 and 1996 at Fouka village in the west-northern coast, which represents semiarid and temperate climate. The experimental program consisted of three trials. Two tests were carried out in vine area, while the third was in acacia tree area.

In the first test, circular trenches (40 cm wide and depth each) were established 30 cm a plant apart, dug and soil were removed. A specific liquid volume of known chemical concentration (1, 2%) was poured into each trench. The removed soil was replaced, where corrugated cardboard roll was placed in the center of trench as bait. The trenches treated with water were considered as control blocks.

The second test was also conducted in vine area using the concrete slab method, where the trench was covered with sheet of polyethylene and concrete, serving as vapor barrier. Also, this test included trenches without covering sheet for comparison.

Third test was located in acacia with the same procedures of the first one, but using the wooden baits as well as cardboard rolls.

Each trial was replicated three times in a complete randomized block design. Samples of baits for each treatment were taken after 3, 6 and 12 months of treatment, cleaned gently from soil and oven-dried at 80°C for 8 hrs. The dry weight was determined and the remainder is equal to protective value.

Data were subjected to ANOVA and means were compared according to LSD test at 0.05 level (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Data in Table 1 indicate the protective efficacy of tested chemicals on infestation after 3, 6 and 12 months of soil treatments in vine area. Dagnet showed pronounced effect for one year, giving 100 and 92.95% control at 1 and 2% concentrations, respectively. Also, 1 and 2% cidial induced efficacy of 94.32 and 97.47%,

Table 1. Efficacy of chemicals applied as soil treatments to subterranean termite *M.eugnathus* in vine area at Fouka, the west-northern coast during December 1995 and 1996.

Chemical	% Protective efficacy in months		
	3	6	12
Control	80.00 a	79.99 a	54.29 a
Copper sulphate 1%	96.24 b	86.61 b	79.21 cd
Copper sulphate 2%	97.78 bcd	93.17 def	86.68 e
Borax 1%	95.01 b	90.28 bcd	73.84 bc
Borax 2%	96.33 bc	92.00 cde	81.23 d
Dimilin 1%	96.00 b	88.02 bc	71.73 b
Dimilin 2%	98.50 cd	94.30 ef	82.54 de
Dagnet 1%	100.00 e	99.61 g	92.95 f
Dagnet 2%	100.00 e	100.00 g	100.00 h
Cidial 1%	99.30 de	96.33 f	94.32 f
Cidial 2%	100.00 e	100.00 g	97.47 g

Means followed by the same letter are not significantly different, at $P = 0.05$.

respectively. These findings agree with those obtained by Kard et al., (1989), who stated that most termiticides (Organophosphates and pyrethroids) have provided 100% control for the first five years and 80-100% control for six and ten years.

As indicated in Table 1, the inorganic salts of copper sulphate and borax, and insect growth regulator (dimilin) gave good control to *M.eugnathus*, not less than 70% control after one year. Ahmed et al., (1986) demonstrated that dimilin gave high mortality, inhibition of nymphal moulting, fertility and egg viability of studied termite species. The termiticidal properties of dimilin have been reported by Doppelreiter and Koriath (1982) together with its suitability for wood preservation. Significant differences in the results were noticed among treatments as well as between treatments and control. The potency varied depending on the concentrations and period after treatment.

Data in Table 2 show the relative potency of tested chemicals against *M.eugnathus* in vine area with two test methods; uncovered treatments (I) and covered with a concrete slab (II). Cidial, sumicidin and cyanox at 1 and 2% concentration gave the highest protection to *M.eugnathus*, particularly when these treatments were covered with a concrete slab. One year after treatment of 2% cidial, sumicidin and cyanox gave 97.47, 99.04 and 94.6% protection, respectively with the method (I), while the method (II) induced 100, 99.39 and 98.36% efficacy, respectively. Copper sulphate at 2% gave 95.22% efficacy for one year with a concrete slab, but it was 86.68% with uncovered trenches. Similar results were obtained by applying method (II), where 1% concentration of the tested chemicals gave the highest effect in comparison to method (I). Thus, use of a concrete slab could play a role in prolonging the efficacy of termiticides to subterranean termites. This method has been mentioned by Sorenson (1955) to prevent the attack of termites and minimize the reduction of soil treatments by leaching or other causes (Gray and Wetherly, 1959). Weather conditions such as temperatures, ultraviolet light, rainfall as well as pH and soil type affect the longevity of the termiticides in soil (Harris, 1964; Smith, 1966).

Concerning the third test in acacia tree area, data in Table 3 showed efficiency of the inorganic salts against infestation of baits with *M.eugnathus*. In baits of corrugated cardboard, 5% sodium fluoride, copper sulphate and borax gave more than 96% protection for one year. Similar results were noticed with wooden baits, showing the highest effect of copper sulphate (96.79%) followed by sodium fluoride (93.15%) and borax (92.75%). Salman and Sayed (1990) mentioned that 10% cop-

Table 2. Efficacy of chemicals applied as soil treatments to subterranean termite *M.eugnathus* with two test methods in vine area, at Fouka, the west-northern coast during December 1995 and 1996.

Chemical	Test method	% Protective efficacy in months		
		3	6	12
Control	I	80.00 a	79.99 a	54.29 a
Control	II	93.62 b	88.74 bc	71.33 b
Sumicidin 1%	I	98.67 cde	94.40 def	91.98 ef
Sumicidin 1%	II	99.32 de	98.00 g	94.88 fg
Sumicidin 2%	I	100.00 e	98.12 gh	99.04 kl
Sumicidin 2%	II	100.00 e	100.00 h	99.39 kl
Cidial 1%	I	99.33 de	96.24 efg	94.32 fg
Cidial 1%	II	100.00 e	99.95 h	99.06 kl
Cidial 2%	I	100.00 e	100.00 h	97.47 ghk
Cidial 2%	II	100.00 e	100.00 h	100.00 l
Cyanox 1%	I	98.59 cde	90.77 bcd	85.27 cd
Cyanox 1%	II	99.35 de	96.11 f	95.15 gh
Cyanox 2%	I	99.57 de	96.27 f	94.60 fg
Cyanox 2%	II	100.00 e	100.00 h	98.36 hkl
Copper sulphate 1%	I	96.24 bc	86.61 ab	79.21 bc
Copper sulphate 1%	II	97.56 cd	86.90 ab	88.33 de
Copper sulphate 2%	I	97.78 cd	93.17 cde	86.68 de
Copper sulphate 2%	II	99.00 de	96.38 g	95.22 gh

I = uncovered treatments, and II = treatments covered with a concrete slab.
Means followed by the same letter are not significantly different, at P = 0.05.

per sulphate and borax inhibited attack of the termite, *Psamotermes hypostoma* De-sneux, for 6 and 12 months, respectively in Kharga, New Valley.

From the results in Tables 1 and 2, the lowest concentrations 1% of copper sulphate, cyanox, sumicidin, cidial and dragnet showed protection of 85-95% for one year. These findings may help to reduce the dosages and numbers of termiticides used.

Finally, the results demonstrated the superior effects of dragnet, cidial and sumicidin on *M.eugnathus*, thereby such treatments could be employed in IPM program to suppress termite populations and damage.

Table 3. Efficacy of chemicals applied as soil treatments to subterranean termite *M.eugnathus* in acacia area at Fouka, the west-northern coast during December 1995 and 1996.

Chemical	Bait	% Protective efficacy in months		
		3	6	12
Control	I	89.35 a	71.37 a	58.17 a
Sodium fluoride 5%		99.93 b	99.25 b	98.71 b
Copper sulphate 5%		99.87 b	98.40 b	97.35 b
Borax 5%		99.81 b	98.37 b	96.84 b
Control	II	91.96 a	77.42 a	65.19 a
Sodium fluoride 5%		98.34 b	94.66 b	93.15 b
Copper sulphate 5%		99.57 b	98.04 c	96.79 c
Borax 5%		98.69 b	94.94 b	92.75 b

I = corrugated cardboard roll, and II = wooden baits .

Means followed by the same letter are not significantly different, at P = 0.05.

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فعالية معاملات التربة فى مكافحة النمل الأبيض تحت الأرضى
(مايكروثيروترميس ايجوناثيوس) فى مناطق
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يستهدف البحث مكافحة حشرة النمل الأبيض تحت الأرضى مايكروثيروترميس ايجوناثيوس والتي تسبب خسائر ضخمة للمباني السكنية الخشبية والإنتاج النباتى مثل العنب وأشجار الأكسيا والأثل والكاورينا فى مناطق الساحل الشمالى الغربى بمصر مما يهدد تنمية تلك المناطق. وتناول البحث إجراء ثلاث تجارب فى مساحات العنب والأكاسيا بمنطقة فوكة لتقييم مجموعة واسعة من الكيماويات ضد أضرار تلك الآفة.

ولقد أظهرت نتائج التجربة الأولى فى منطقة العنب الكفاءة العالية لمبيد دراجنت (بيروثرويد)، سيديال (فوسفورى عضوى) بالإضافة إلى الفعالية الجيدة للديميلن (منظم نمو)، كبريتات النحاس وبوراكس (أملاح غير عضوية) وتترايد فعالية تلك المركبات مع تزايد التركيز المستخدم. حيث أظهرت تلك المركبات عند التركيز ٢٪ كفاءة فى وقاية الطعوم بعد سنة واحدة بما يعادل ١٠٠، ٩٧، ٤٧، ٨٢، ٥٤، ٨٦، ٦٨، ٨١، ٢٣٪ بينما كانت كفاءة التركيز ١٪ كما يلى : ٩٢، ٩٥، ٩٤، ٣٢، ٧١، ٧٣، ٧٩، ٢١، ٧٣، ٨٤٪ على التوالى. وكانت القيمة المتبقية فى الكونترول تعادل ٥٤، ٢٩٪.

كذلك أشارت نتائج التجربة الثانية فى منطقة العنب أيضا كفاءة المركبات المستخدمة وخاصة عند تغطية خنادق المعاملات بأغطية بلاستيكية والأسمنت مقارنة بالخنادق غير المغطاة. حيث كانت قيم الكفاءة بعد سنة واحدة من المعاملة تعادل ١٠٠، ٩٩، ٣٩، ٩٨، ٣٦٪ عند تغطية خنادق المعاملات ٢٪ للسيديال، سوميسيدين، سيانوكس بينما كانت تعادل ٩٧، ٤٧، ٩٩، ٠٤، ٩٤، ٦، ٩٤، ٦، ٩٩، ٠٤٪ لتلك المعاملات وغير المغطاة.

كما أظهرت نتائج استخدام معاملات ٥٪ لكل من فلوريد الصوديوم ، كبريتات النحاس، بوراكس فعالية عالية ضد تلك الآفة فى منطقة أشجار الأكاسيا معطية أعلى من ٩٠٪ كفاءة بعد سنة واحدة من المعاملات.