SUSCEPTIBILITY OF THE DRY-WOOD TERMITE *CRYPTOTERMES BREVIS* WALKER TO THE BLACK PEPPER EXTRACTS

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Abstract

Effects of hexane, ethanol and petroleum ether extracts of the black peper fruits, *piper nigrum* L., were studied on the dry-wood termite,*C. brevis*. The results indicated that the hexane extract has excellent efficacy against the insect. Hexane extract at 0.5% concentration induced 50% mortality, which dropped to 4.76 and 14.28% with ethanol and petroleum ether, respectively 2 days post-treatments. Mortalities reached 100.42.85 and 89.29% at 5% conc. of the above mentioned extracts, respectively.

After 14 days, 0.5% conc. of ethanol and petroleum ether gave 67.77 and 65.56% mortality, respectively and both of them induced 100% mortality at 5% concentration.

INTRODUCTION

The dry-wood termite, *Cryptotermes brevis* walker, is a destructive pest of paper, wood and wooden products. In the continuing search for new insect control agents to replace the growing number of traditional, potent insecticides that have been banned for use because of adverse environmental impact, much emphasis has been placed on discovery of new compounds, including natural products from plants with various inhibitory effects on insects.

Several studies have indicated the role of natural products for the control of the subterranean termite (Adams *et al.* 1988; Kawaguchi *et al.* 1989; Su *et al.* 1990; McDaniel 1992). A little is published about the dry-wood termite. Among the natural products, black pepper *Pipper nigrum* L., which showed insecticidal activities (Lathrop and keristead 1946; Su 1977; Scott and Mc kibben 1978; Su Horvat 1981).

In this study, we investigated the effect of crude extracts of black pepper on the dry-wood termite, *C.brevis*, using solvents of hexane, ethanol and petroleum ether.

MATERIALS AND METHODS

Extraction of black pepper: Dry fruits of black pepper were ground in a high-speed micromill into fine powder. Three separate 8-hr extractions with three different solvents; hexane, ethanol and petroleum ether (60-80^{o}C) were performed in a Soxhelt apparatus with 1 litre of solvent for each 100 g of black pepper powder. Finished extracts were filtered through anhydrous sodium sulphate and the solvent removed in vacuo. Each resulting crude extract was measured.

The termite: The dry-wood termite, *C.brevis,* reared in the laboratory of Termite Research Department, at the Agricultural Reseasrch Station, Sabahia, Alexandria on wooden chips maintained at 26 ± 2 ^{o}C and 70 ± 5% R.H. At least, the 4 th nymphal instar was used in the tests.

Bioassay procedure: Stock solution of each extract was obtained by dissolving the yield in acetone and serial concentrations were prepared. Filter paper disks, 6.8 cm diam., were individually treated by dipping in each concentration for 10 sec. Filter papers treated with acetone were used as controls. The treated papers were air-dried to remove solvents and held in 7 cm diam. petri dishes. After that, each paper was exposed to 10 nymphs in closed petri dish with three replicates per concentration. The tests were incubated in a dark cabient at 26 ± 2 ^{o}C and 70 ± 5% R.H. Mortalities were counted at several days after treatment and corrected using Abbott's formula (Abbott, 1925).

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

RESULTS AND DISCUSSION

The effects of crude extracts of hexane, ethanal and petroleum ether of black pepper fruits on *C.brevis* nymphs are shown in Table1. The mortality of termites treated with 0.5% concentration of hexane extract was 50% after 2 days of exposure. Percentage mortalities were ranged from 71.43 to 100% at the concentrations of 0.75 to 5% after 2 days. At 0.75% conc., all termites died within 3 days.

At 0.5% conc., the effect of petroleum ether extract was 14.28% mortality after 2 days. Mortality rapidly increased after this period, giving 30.72, 40.36, 50.36 and 65.36% after 3, 5, 7, and 14 days of exposure, respectively. The extract started to show above 50% mortality at 1% conc. after 3 days. A 5% conc. gave 100% mortality.

The third extract (ethanol extract) was somewhat less active and showed 4.76% mortality with 0.5% conc. after 2 days. When a paper was applied with ethanol extract, mortality was significantly increased with the highest concentrations. The conc. 5% induced 53.81% mortality after 3 days and reached to 88.89% after 14 days. The nymphs died within 14 days with the concentration of 2.5%.

The results indicate significant difference among the solvents, concentration of the extractable material and days of exposure. The bioassay of hexane extract (non polar) showed considerable activity on *C.brevis* followed by petroleum ether extract. Ethanol simply does not completely extract the active components, or it may indicate the presence of additional and more non polar toxic components.

Su and Horvat (1981) mentioned that three amides were isolated from *Piper nigrum* and identified from their spectral characteristics as (E,E)-N- (2-methylpropyl)-2,4- dacadienamide (I), (E,E,E)-13-(1,3-benzodioxol-5-yl)-N-(2-methylpoyl)-2,4,12-tridecatrienamide (II), and (E,E,E)-II-(1,3-benzodioxol-5-yl)-N-(2-methylpropyl)-2, 4,10-undecatrienamide (III). Also, they indicated their contact toxicity on the cowpea weevils. Su (1977) stated that piperine, an alkaloidal amide of oleoresin of pepper, was not the constituent in black pepper than was responsible for contact toxicity to insects.

In conclusion, black pepper fruits contain a component (s) against *C.brevis* . For this reason, extracts of black pepper may be useful for controlling this insect and protecting wood and wooden products.

Table 1. Effects of black pepper extracts on the dry-wood termite, *C.brevis*.

Extractive solvent	Conc. (%)	Mortality (%) at indicated days after treatment					Grand Means
		2	3	5	7	14	
Ethanol	0.5	4.67 a	10.24 a	26.91 a	49.95 a	67.77 a	
	0.75	9.52 a	46.11 bc	53.18 abc	64.58 abc	77.78 ab	
	1	21.42 ab	53.81 bcd	60.24 bcd	69.97 abcd	88.89 ab	
	2.5	28.57 ab	53.81 bcd	61.51 bcd	88.89 ab	100 b	
	5	42.85 bc	76.91 cde	83.97 cde	92.3 de	100 b	57.00 A
Hexane	0.5	50 bc	69.21 bcd	76.91 bcd	84.6 cde	88.89 ab	
	0.75	71.43 cd	100 e	--	--	--	
	1	85.71 de	100 e	--	--	--	
	2.5	92.86 de	100 e	--	--	--	
	5	100 e	--	--	--	--	84.97 B
Petroleum ether	0.5	14.28 ab	30.72 ab	40.36 ab	50.35 a	65.36 a	
	0.75	25 ab	35.71 ab	50 ab	56.67 a	66.67 a	
	1	42.85 bc	56.03 bcd	59.6 abc	64.58 abcd	77.78 ab	
	2.5	50 bc	78.57 de	83.33 de	89.99 cde	100 b	
	5	89.29 de	100 e	--	--	--	60.33 C

Means followed by the same letter (for each column) are not significantly different at 0.05 level by LSD test.

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حساسية النمل الأبيض *Cryptotermes brevis* التى تصيب الأخشاب الجافة لمستخلصات الفلفل الأسود

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بستهدف البحث تطبيق مستخلصات الفلفل الأسود فى مكافحة النمل الأبيض التى تصيب الإخشاب الجافة وبالتالى تقليل التلوث البيئ الناتج عن الإستخدام المكثف للمبيدات الكيماوية .

ولذا تناولت الدراسة فعالية مستخلصات ثمار القلقل الأسود مع كل من مذيب الهكسان ، إيثانول ، بتروليم إيثر ضد حوريات النمل الأبيض *C.brevis*

وقد أعطت مستخلصات الهكسان نتائج جيدة مقارنة بمستخلص الإيثانول وبتروليم إيثر . حيث أحدث التركيز ٠,٥٪ لمستخلص الهكسان موت ٥٠٪ للحوريات بعد يومين من المعاملة، بينما كانت القيم المناظرة تعادل ٤,٧٦ و ١٤,٢٨٪ مع مستخلص الإيثانول وبتروليم إيثر على التوالى . كما أدى التركيز ٥٪ لتلك المستخلصات الثلاث إلى موت ١٠٠٪ و٤٢,٨٥ ٪ و٨٩,٢٩ ٪ على التوالى .

وبعد ١٤ يوما من التعريض للتركيز ٠,٥٪ لمستخلص الإيثانول وبتروليم إيثر كانت النسبة المئوية للموت ٦٧,٧٧ ٪ و٣٥,٣٦٪ على التوالى ، بينما إرتفعت إلى ١٠٠٪ لكليهما عند التركيز ٥٪.