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Effect of Some Botanical Pesticides on Feeding Activity of *Microtermes najdensis* (Isoptera: Termitidae)

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ABSTRACT

Termites are serious insect pests in Yemen. Insecticidal control of termites is largely dependent on chlorinated hydrocarbons that cause residue problems and have harmful serious effects on humans, animals, and the environment. Therefore, there is a need to find alternative treatments against termites. Wood blocks (10x7x2.5 cm), buried in soil, were them treated by botanical materials (10% solution and 24% aldrin) at the rate of 50 ml per block. Mean weight loss of the wood blocks, due to termites feeding, was significantly higher in untreated blocks than all treated blocks. Applying 50 ml/block with a mixture of 1/2 dosage of aldrin and 1/2 dosage of *Azadirchta indica* A. Juss kernel extract showed the best protection followed by aldrin, A. *indica and Melia azedarach* (L.).

Key Words: Termite, Neem, Botanical Pesticides

INTRODUCTION

The termite, *Microtermes najdensis* Harris (Isoptera: Termitidae), is the most destructive and economically important insect pest of crops, various vegetables and fruits as well as other cellulose products in Yemen. This pest is known to be widely distributed throughout Tihama (Wood et al., 1986). At present, insecticidal control of termites in corps, pastures and houses is largely dependent on chlorinated hydrocarbons, such as aldrin, dieldrin, DDT, chlordane, and others (Harris, 1971; Sauds, 1977; Johnson and Wood, 1980; Sen-sarma, 1986). These chemicals give an excellent control, but cause residue problems due to their high persistence and harmful effect on humans, animals, and the environment (Beal and Smith, 1972; Beal, 1980; Ulsperger, 1984; Ashworth, 1985; Badawi and Faragalla, 1986; Wood et al., 1987; Kassem and Ahmed, 1988). Since no enough alternative is available to control termites, farmers still insist on using chlorinated pesticides to protect their crops, in spite of many serious health effects

that have occurred in several areas (Ulsperger, 1984). Therefore, it is curcial to search for other alternative apprauches.

Wide range of plants contain compounds which kill insects or possess antifeedant proterties (Harbone, 1968) have been considered for use as insecticides (Stoll, 1986; and Gerrits and Van Latum, 1988). Among these are *Azadriachata indica* A. Juss and *Melia azedarach* (L.) which showed antifeedant effects (Schmuttere, 1985; Chiu, 1993); disrupt insect development (Al-Hemyari, 1993; Grant and Schmuttere, 1987) and sterilants (Schumttere, 1987). Since little is known about the effect of botanical insecticides on termites, field tests should be carried out to develop safe and economic methods of termite control. The purpose of this study was to evaluate some botanical maerials, known to be present in locally, grown trees. The ultimate goal is to find the most appropriate and effective materials that are less persistent than chlorinated pesticides and are safe for humans, animals, and the environment.

MATERIALS AND METHODS

Preparation of extracts: Mature fruits of *Melia azedarach* and kernels of *Azadirachta indica* were collected from Tihama, Yemen, air-dried and ground with an electric mill (0.84mm) to obtain a powder. One hundred grams of the powder from each of the two species were added separately to one litter of tap water and thoroughly mixed using electric blender. The solution was filtered twice through musline cloth and filter paper (p4 medium-fine), then poured into beakers and left for 24 hours. Solutions of 10% concentration of each were prepared and stored in a refrigerator until needed.

Field test: The experiment was conducted in Zabid (Tihama), Yemen, during February, 1992 and 1993. The efficacy of botanical insecticides was determined using a randomized complete block design experiment with five treatments, including an untreated control. Treatments were replicated four times. Soft wood blocks (10 x 7 x 2.5 cm) of *Pinus sylrestris* were oven dried at 105^0 C for 24 hrs., weighted, and labeled. A termites infested area (10 x 10 m) was cleaned of shrubs, grasses, and dead wood, and was subsequently divided into 20 continuous study plots (5 m^2 each).

Four wood bocks were inserted in the soil of each pot to form a square pattern. Treatments consisted of 50ml of 10% *M. azedarach* extract, 50ml of 10% *A. indica* extract, 50ml of 24% aldrin (0.05 g a.i./block) were applied separately to each block. In the mixed treatment of 1/2 dosage of aldrin plus 5% of *A. indica* solution, the mixture was applied at 50ml volume to each block. Ten days later, two blocks of

each treatment in each replication were picked up, cleaned of any debris or soil, ovendried at 105^0 C for 24 hrs, and weighed. The same procedure was repeated after 20 days for the remaining blocks.

Differences between the weights of the blocks before and after insertion in the soil were recorded to determine wood consumption. It was assumed that weight lost by the blocks was due entirely to termites feeding. Results were subjected to one way ANOVA, and means were separeated at P = 0.05 by the Student Newman-Keuls Test (which computer sofware or book as reference for this test).

RESULTS AND DISCUSSION

In 1992, the difference in mean weight loss between treated and untreated wood blocks was significant (P = 0.05) (Table 1, 1st inspection after 10 days). The mixture of aldrin and A. indica provided the best wood blocks protection followed by aldrin and *A. indica*. *M. azedarach* spelling was the least effective protectant treatment. The second inspection (20 days later) revealed more feeding activity (Table 1). However, the trend is approximately similar to the first inspection, except for blocks treated with *M. azedarch* that indicated no significan difference from untreated wood blocks.

Table 1. Efficacy of botanical and chlorinated pesticides in controlling weight loss of wood blocks of *Pinus sylrestris* exposed to *M. najdenses* attack, Tihama, Yemen, 1992.

Treatment	Mean Weight Loss (%)	
	wood pickedup after 10 days	wood pickedup after 20 days
	x + s	x + s
Aldirn+*A. indica*	1.74 + 0.	3.56 + 2.29[a]
Aldrin	3.83 + 1.71[a]	3.62 + 1.05[a]
A. indica	9.60 + 3.17[a]	13.62 + 3.55[a]
M. azedarach	38.69 + 13.16[b]	66.61 + 21.64[b]
Untreated	65.32 + 17.71[c]	87.43 + 11.31[b]

Means (± Standard Deviation /Error), followed by same letters, are not significantly different at 0.05 level.

In 1993, weight loss of wood blocks in all treatments at first inspection was significanlty less than in the untreated except for the blocks treated with *M.azedarch* (Table 2). The percentage of weight loss of blocks was lowestas in table 2 for the mixture of *A. indica* and

aldrin (0.82, 2.46%) followed by aldirn (2.29, 3.34%), *A. indica* (4.64, 10.36%), and *M. azedarch* (32.47, 54.36%) treatments. The trend of significant differences among treatments, in both inspections was almost the same, but percentage of consumption was higher in the second inspection than at the first.

In both years, *A. indica*, aldrin, and their mixture were more effective in contolling termite damage than *M. azedarach.* The difference in severity of attack becomes apparent between the control and the treated blocks. Although aldrin showed better protection in both inspections, the difference in wood consumption was not statistically significant when compared with that of *A. indica.*

Table 2. Efficacy of some botanical and chlorinated pesticides in controlling weight loss of wood blocks of *pinus syrestris* exposed to *M. najdenes* Attack, Tihama, Yemen, 1993.

Treatment	Mean Weight Loss (%)	
	wood picked up after 10 days	wood picked up after 20 days
	x + s	x + s
Aldirn+*A.Indica*	0.82 + 0.58 [a]	2.46 + 1.60[a]
Aldrin	2.29 + 3.09[a]	3.34 + 1.87[a]
A. indica	4.64 + 2.6[a]	10.36 + 3.02[a]
M. azedarach	32.47 + 14.39[ab]	54.36 + 28.39[b]
Untreated	58.05 + 28.89[b]	75.30 + 16.41[c]

Means (± Standard Deviation/Error) followed by same letters are not significantly different at 0.05 level.

M. azedaach, in both years, was significantly less effective than all other treatments. Similar findings were reported by Hanif-Gul et al., (1980) who tested stakes of 13 tree species exposed to termites and found that the only treated stakes consumed by termites were those treated with *M. azedarach.* Termites fed for 7 days with seed powder of *M. azedarach* had 65% mortality (Lin and Wang, 1988).

The results of this study indicated that *M. najdensis* generally did not avoid foraging on wood blocks treated with *A. indica.* However, the damage for all inspected blocks was less than 13.62%. This suggests that termite workers had been virtually eliminated by either the toxicity of the A. indica or by its deterrent effect. Tis is in agreement with studies by Alder and Vebel (1984) who stated that Margarine (commercial name for *A. indica* extract) showed antifeedant activity

against *Dissoleira carolina*, *Diapheromera fermorala* and *Gryllus pennylranicus*. Vankateswarla et al., (1988) stated that neem oil at 8-16% exhibited complete repellency and antifeedent activity against *Spodoptera litura.*

Schumuttere (1988) stated that *Schistocerca gregoria* preferred to die from starvation than to feed on treated food plants. Japanese beetle, *Popillia japonica,* was deterred from feeding on soybean leaves treated by a 1% aqueous emulsion of neem seed kernel extracts (Schmuttere, 1987). This study extends ther observation to the termite, *M. najdensis*

Comparison of first and second inspection for both years, showed that mean wood consumption was higher after 20 days than after ten days. This is true with most plants-based insecticides which break down rapidly in soil due to many physical and biological factors. For the same reasons, they do not give the prologed protection to crops and trees required to control termite (Logan et al, 1990).

In conclusion, this study demonstrated that *A. indica* kernel extract effectively suppressed *M. najdensis* activity in a region where this termite is a major economic pest. However, the extact showed limited persistence under field conditions. This means that the residue effect losts for short period and thus does not present long term environmental problem. Using *A. indica* kernel extract as a pesticide against termites would required several applications to protect the wood.

Azadirachta indica is locally available and can by crushed and used without complicated extraction procedures. In addition, it has low toxicity to environment and non-target organisms, especially humans and beneficial insects. Therefore, *A. indica* could be suitable for integreated pest management. Further research is needed on the active compounds which may lead to the development of nontoxic repellent or feeding deterrent. More research in mixing *A. indica* with synergists or low toxicity pesticides is also necessary to develop inexpensive, effecive, and environmentally sound pesticides.

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تأثير بعض المبيدات النباتية على النشاط الغذائي للنملة البيضاء

Effect of some botanical pesticides on feeding activity of *Microtermes najdensis* (Isoptera Termitidae)

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ملخص :

يعتبر النمل الأبيض من الآفات الخطيرة في اليمن ، ويعتمد في مكافحة هذه الحشرة وبصورة أساسية على المبيدات الكلورية ، وهذه المبيدات تسبب كثير من المشاكل الخطيرة للإنسان والحيوان والبيئة . ولهذا دعت الحاجة الى البحث عن طرق أخرى لمكافحة النمل الأبيض .

أجريت التجربة في منطقة تهامة اليمن وفي قطعة أرض تم تنظيفها من المخلفات النباتية ثم غرست قطع خشبيـر (١٠×٧سم) في التربة وعوملت كل قطعة منفردة بمستخلص بذور نباتية وبتركيز (١٠٪) و (٢٤٪) الدرين بواقع ٥٠ ملم/ لكل قطعة ، وجد أن متوسط النقص من وزن القطع والناتج عن تغذية النمل الأبيض عليها كان ذو فارق معنوي عال مقارنة بالنقص في القطع التي لم تعامل . وفي القطع الخشبية التي عوملت بنصف التركيز من Azadirachta indica وبنصف التركيز من الدرين ملخوطا وبواقع ٥٠ ملم/ لكل قطعة أعطت حماية عالية يليه اللدرين ثم A. indica وأخير Melia azedarach .

كلمات مفتاحية : النمل الأبيض ، النيم ، المبيدات النباتية .