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RESEARCH ARTICLE

CONTROL OF SUBTERRANEAN TERMITES BY ETHANOLIC LEAF EXTRACT OF PLANT *GLIRICIDIA SEPIUM* (JACQ.) AND COMPARED IT WITH DIELDRIN

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ABSTRACT

Studies were conducted with a view to promote indigenous pesticides for the control of subterranean termites. Different concentrations (0.5%, 01% & 1.5%) of ethanolic leaf extract of *Gliricidiasepium*(Jacq.) and Dieldrin were prepared respectively. Stakes treated with 0.5% of ethanolic leaf extract of *G.sepium* were showed severely damaged by termites in one year, similarly stakes treated with 01% were damaged by termites whereas stakes treated with 1.5% were found to be highly effective against termites and Dieldrin were remained un attacked by termites up to one year. Controlled stakes were severely damaged by termites within six months.

INTRODUCTION

Termites are social insects, living in colonies, often called "white ants" but in actual way they are not ants because the termites belong to order Isoptera, while ants belong to order Hymenoptera (Grimaldi *et al.,* 2005), different groups of termites include in diverse and large species of insects (Eggleton, 2000).

There are 170 genera and about 2600 species in which 300 species have great importance. On the basis of their habitat they can be categorized into three groups, i.e damp wood, dry wood and subterranean termites (Paul and Rueben, 2005). The fungus growing termites are the destructive termites in Pakistan (Anonymous, 2000). There are 50 species of termites were included in fauna of Pakistan. (Shahid *et al,* 1992 and Akhtar *et al.,* 1993).

The destructive activity is the most outstanding features of termites.(Ibrahim *et al*.,2012). *Heleratermes indicola* is the most destructive species of termites (Manzoor, *et al.*2012). Majority of the species attack on crops and cause serious effects (Ahmed *et al.,* 2006), so the crops are unable to survive properly (Robinson, 2005*).* The feeding habits of termites are the wide spread destructive problematic condition effect on agriculture crops (Abe *et al.,* 2000). According to estimation the millions of cash annually are used up in worldwide against of termites (Tsunoda, 2003).

In serious contaminated areas dieldrin compounds were applied to control the infections and killed termites. In 1988 the use of organochlorine was banned as termiticides (Ware, 2000), because it spreadsits toxic effects on the environment which were harmful for human health and other organisms (Walker and Newton, 1998). Many plants have been recognized as repellent insecticides against different pests especially for control of termites (Sing *et al.,* 2001 and Zhu *et al.,* 2001). In Pakistan the termites are controlled by the applications of insecticides (Ahmed *et al.,* 2007).According to estimation the non-repellent introduced in the beginning of 2000, they are frequently used as a chemical for control of termites, but they have combined qualities, where it plays effective role as well as these compounds are cost effective (Wagner *et al.,* 2003).

Research on *G.sepium* for the first time in Pakistan is being conceded at PCSIR labs complex, Karachi (Nazli *et al.,* 2008) .This plant is being utilized for fuel timber, animals nourish, living fences, green mulch, gloom and as support plant.(Csurhes and Edwards, 1998).

MATERIALS AND METHODS

Plants collection and processing

Gliricidia plant leaves were collected from Coastal Agriculture Research Station, SARC, PARC,Karachi. All the leaves samples were preserved in wax-quoted paper bags and brought to the laboratory for biological assays.

Plant extraction

The fresh dried leaves of *G.sepium* (5kg) were ground and soaked in ethanol (commercial, doubly distilled 50 lit). The filtrate was concentrated under reduced pressure at 40^{O}C to a gum. This crude gum was used for activity purpose.

METHODS

Chir wood (*Pinusroxburghii*Sarg.) was selected for graveyard testing and wooden stakes of size 16″ x 3″x 1.5″ inches were cut and aluminium number plates were fixed on each stakes and were dried in oven at 90^{0}C. The weight of each stake was noted before and after drying. Different concentrations of

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Ethanolic leaf extract of plant *G.sepium*, developed at PCSIR Labs. Complex, Karachi and Dieldrin (Hexachloro-epoxyocta-hydro-dimethanonapthalene) a standard wood preservative was prepared of 0.5%,1% and 1.5% ranges in water. Four stakes were dipped in each concentration for 24 hours at room temperature (27^0C). Afterward they were kept for drying upto 24 hours at the same temperature. The weight of each stake was noted again in order to find out pesticide absorption in each case. The treated and controlled stakes were embedded in termites infested soil to a depth of 14 inches apart and similar distance was left between each row. They were linked together by 4 inches wide.

Statistical Analysis

The data was subjected to the analysis of ± standard error of mean and standard deviation calculated by SPSS ver-17 program to examine the difference between each treatment. The level of statistical significance was set at $p \geq 0.05$.

RESULT AND DISCUSSION

After examined the chemicals and natural insecticides, the recent work on natural pesticides, that are derived from plants and their different parts (roots, stems, leaves, barks) had been carried out. In this project *G. sepiumwas* for the first time introduced for its preliminary studies as termiticides to control the termites' infestation or damages.

The conditions of controlled and treated woods were inspected in one year, they were categorized as follows:

1. Safe samples stakes remained unattacked by termites (S).
2. Slightly damaged samples/stakes damaged by termites upto 10% (SD).
3. Damaged samples/stakes devoured by termites more than 20% (D).
4. Severely damaged samples/stakes heavily infested by termites more than 40% (SSD).

Treated and untreated wooden samples were taken out from PCSIR Complex, Karachi. The aim of the present studies was to use chemicals and natural occurring antitermite compounds which were extracted from leaves of *G. sepium*and showed promising results to control the termites, with its three different concentrations i.e. 0.5%, 01%, and 1.5% weredeveloped at PCSIR labs. Complex, Karachi, and Dieldrin compound (Hexachloro- epoxyocta- hydro-dime than naphthalene) a standard wood preservative was prepared with concentrations of 0.5%, 01% and 1.5% in water, for preliminary experiment to check its efficacy against termites. Without treatment stakes served as controlled, mortality count was made after 3 months of treatment.

In this project the toxic effects of chemicals, i.e. dieldrin and leaf extracts of versatile plant *G. sepium against* injurious species of termites were observed and found that the plant *G.sepium* showed maximum termiticidal effects against termites in soil. In the light of above these investigations it is inferred that ethanolic leaf extract of *G.sepium* not only shows as mosquito repellent and nematicidal characteristics (Nazli, 2008) and microbial properties (Nazli, 2011*)*,but also can be used as termiticides for the control of termites under normal conditions.

G.sepium showed highly significant termiticidal effect against infection only at its high concentration as compare to Dieldrin (standard pesticide against termites). This was preliminary study in Pakistan in which ethanolic leaf extract of *G. sepium was* tested as termiticide, which shows the termites repelling properties. Dieldrin was found to be effective significantly (0.5%, 01% and 1.5%) against termites up to one year in this experiment. Stakes treated with 0.5% of ethanolic leaf extract of *G.sepium* were found 37±9.9% attacked by termites in one year. Similarly stakes treated with 01% were infested by termites 20.8±5.3% in one year. Stakes treated with 1.5% were found to be highly effective 7.2±1.4% against

Table 1main characters of different species of termites

Main Characteristics	Subterranean Termites	Dry wood Termites	Damp wood Termites
Colony size	Large	Small	Small
Nest location	Both in soil and above Ground level	In wood or timber	In damp Areas
Water required	Yes	No	Yes
Damages	Sheets or wood made materials	Holes in wood	Wood
Body colour	Yellowish brown	Light brown	Offwhite or cream colour
Body size	12-15mm	11mm	20mm
True worker caste	Yes	No	No
Distribution	State wide	State wide	State wide

Table2 Efficacy of *G.sepium* against Termites comparison with Dieldrin under field condition

Name of Pesticides	Concen-tration	Replicate	Stakes safe / damage after		
			1 year	% mortality	Mean mortality
Ethanolic leaf extract of *G.sepium*	0.5%	4	SSD(37±9.9%)	41%	37±9.9%
	01%	4	D(20.8±5.3%)	22.8%	20.8±5.3%
	1.5%	4	SD(7.2±1.4%)	8.3%	7.2±1.4%
Dieldrin	0.5%	4	S	S	S
	01%	4	S	S	S
	1.5%	4	S	S	S
Control	-	12	3 months SD(39.24±51.66%) 6 months SSD(11.23±93.58)	-	-

S= Safe against termites. SD= Slightly damaged
D= Damaged. SSD= Severely damaged

termites' attack which shows the termites repelling properties. Controlled stakes were highly damaged after three months and severely damaged within six months. The differences of damages to stakes treated with ethanolic leaf extract of *G.sepium* in one year were due to residual toxic effects of extracts which shows the termites repelling properties. It was also noted that some controlled samples were severely damaged or decayed within one year but the treated stakes were safe against decaying in the soil which shows that ethanolic leaf extract of *G.sepium* have termiticidal activity.

Table 3 Effect of Ethanolic leaf extract of *G.sepium* as termiticides on termites infestation at three different concentrations (0.5%, 01%, 1.5%). termites

Treatment	Mean	Std. Deviation	Std. Error of Mean	Variance
Control	10.7250	0.763216 b	0.38161	0.582
0.5% Extract	9.2500	0.95742 a	0.47871	0.917
1% Extract	7.2000	0.424264 c	0.21213	0.180
1.5% Extract	3.2000	0.35590 d	0.17795	0.127

Treatment	Mean
CONTROL	10.725^{b} (±0.3816)
0.5% Extract	9.25^{a} (±0.4787)
1% Extract	7.2^{c} (±0.2121)
1.5% Extract	3.2^{d} (±0.1779)

Reading following the mean reading is calculated as ±standard error of mean

Alphabet at mean reading are following the probability level of standard deviation.

- Values in parenthesis indicate ± standard error of mean of at least 4 replicates.
- Mean followed by letter shows significant result at the level of ± standard deviation.

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