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ANTITERMITE ACTIVITY OF CORDIA DICHOTOMA

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ABSTRACT

In the present investigation, we have tested antitermite responses of *Cordia dichotoma* leaves extracts to *Odontotermes obesus* in various bioassays. Leaves of *Cordia dichotoma* were extracted with methanol and fractionated with Different solvents. These extracts and their toxic fractions were evaluated at different dilutions i.e. (0.5%, 1%, 2%) against *Odontotermes obesus*, the test termite. The 2% ethyl acetate extract possesses highest antitermite potential.

Keywords: *Cordia dichotoma, Odontotermes obesus,* Termite mortality

INTRODUCTION

The Indian white termite, *Odontotermes obesus* Rambur (Isoptera: Odontotermitidae), is highly destructive polyphagous insect pest, lives in huge mounds, and feeds on cellulose material an almost anything which contains carbohydrate. It causes economic damage to commercial wood, fibers cellulose, sheets, papers, clothes, woolens and mats, and woody building material and infests green standing foliages, cereals stored in godown. Both worker and soldier termites harm non seasoned commercial wood and its formed materials. Whether it is a rural area or an urban domestic site, termite menace is everywhere. However, for controlling termite population in the field, various synthetic pesticides such as chlorodane [1], cypermethrin [2], hydroquinone, and indoxacarb [3] have been used. But all such synthetic pesticides are highly poisonous and kill non target organisms. Due to their longer residual persistence in the environment, these have been banned and new alternatives are discovered in form of natural pesticides. These plant-origin natural pesticides provide wide range of control and efficiently cut down the population of all kinds of pests even applied in very low quantity. These plant-origin pesticides are much safer and easily biodegradable in the medium and show no residual effect. So far numbers of plant species have been screened to explore potential antitermite agents by the researchers to control termite menace. Few natural products such as flavonoids [4],sesquiterpenes [5] and thiophenes [6] isolated from different plants species were found effective against termites [7]. In addition, for enhancing the insecticidal potential of crude plant extracts and its target specificity, few synergists were applied in form of poison baits which successfully exploit feeding, tunneling [8], and

reproductive behavior in termites [9] . Similarly, application of Summon disks and filter paper disks coated with few chitin synthesis inhibitors viz. diflubenzuron, hexaflumuron, and chlorfluazuron [10] controlled the aggregation, feeding and recruitment behavior in *Coptotermes formosanus* termites.

In the present study, different extracts of leaves of *C. dichotoma* have been evaluated for antitermite activity. *C. dichotoma* L. (Boraginaceae) is tree of tropical and subtropical regions, commonly known as Lasaura/Lasura. It is a medium sized tree with short crooked trunk, leaves simple, entire and slightly dentate, elliptical-lanceolate to broad ovate with round and cordate base, flower white, fruit drupe, yellowish brown, pink or nearly black when ripe with viscid sweetish transparent pulp surrounding a central stony part [11]. It grows in sub-Himalayan tract and outer ranges, ascending up to about 1500 m elevation [12]. It is used as immunomodulator, antidiabetic, anthelminitic, diuretic and hepatoprotective in folklore medicine. *C. dichotoma* seeds have disclosed the presence of α-amyrins, betulin, octacosanol, lupeol-3- rhamnoside, β-sitosterol, β-sitosterol-3-glucoside, hentricontanol, hentricontane, taxifolin-3, 5-dirhmnoside and hesperitin-7-rhamnoside [13]. The seed, which contains α-amyrin and toxifolin 3, 5, dirhamnoside, shows significant anti-inflammatory activity by an oral dose of 1gm/kg in albino rats [11]. The seeds of this plant reported to contain fatty acids and flavonoids [13]. The goal of the present study was to investigate the antitermite activity of different solvent extracts of *C. dichotoma* leaves.

MATERIALS AND METHODS

Collection of Plant Material

The leaves of *Cordia dichotoma* were collected by self in rainy season of the year 2009 from district Lucknow of Uttar Pradesh and authenticated by the Division of Taxonomy and a voucher specimen was deposited in CSIR-National Botanical Research Institute, Lucknow. The leaves of plant material were washed with water, air dried and placed in a drying cabinet at 55-60^{0}C. The dried material was pulverized into fine powder and stored in a covered jar at room temperature.

Preparation of Plant Extracts

The extracts were prepared by extracting 1.5kg of powdered leaves with 1500 ml of methanol via maceration. The extract was subjected to vacuum evaporation on a Buchi rota evaporator. The extract was concentrated in Rotavapour at reduced pressure and the aqueous emulsion was extracted with hexane (5x500 ml) followed by successive washing. The solvent was evaporated under reduced pressure and dried (yield-11.6g). The remaining water soluble portion was again extracted with ethyl acetate (5x500 ml) and n-butanol (5x500 ml), washed with water and dried. Solvent was evaporated under reduced pressure so that 63.06 g. of gummy ethyl acetate extract, 41.75 g of solid n-butanol extract and 53.68 g of water soluble extract were obtained. The final concentration of solutions was 5% which was used as stock solutions for further study. The different concentrations ((0.5%, 1%, 2%) from stock solutions was prepared by diluting with methanol.

Toxicity Bioassay

For evaluation of observation of toxic responses in termites, serial concentrations,

that is, (0.5%, 1%, 2%) of different extracts were loaded on separate Whatman paper strips (1 × 1 cm2) and air dried to remove the solvent. These precoated solvent free strips were placed in the center separate Petri dishes (42mm diameter) as tests and uncoated as control. Twenty-five worker termites were released in the Petri dish to observe the mortality. After setting the experiment, green leaves were provided as food for both tests and control insects and containers were covered with black paper sheets. Mortality was recorded on the basis of dead and living termites, and observations were made in triplicate for each extract and pure compounds up to 24 hrs. Insects were treated as dead when they become immobile and have shown no further activity to the external stimuli. The LD_{50} after 24 hrs of exposure to each was calculated by using Probit analysis tested using the method of Finney [14].

RESULTS

Table 1: Effect of the L. *C. dichotoma* leaves extracts on termite mortality

Extracts	2%		1%		0.5%		Control		LD_{50}
	24 hr	48 hr	24 hr	48 hr	24 hr	48 hr	24 hr	48 hr	
Methanol	22.4±0.3	22.9±0.1	17.2±0.1	17.6±0.2	15.6±0.1	15.9±0.2	5.1±0.3	5.2±0.5	ND
Hexane	9.11±0.1	9.7±0.3	8.34±0.1	8.5±0.2	7.6±0.1	7.7±0.2	4.3±0.4	4.4±0.3	ND
Ethyl Acetate	63.3±0.1	68.7±0.2	41.3±0.3	44.3±0.1	38.2±0.4	39.2±0.2	3.5±0.1	3.8±0.4	4.8-5.5
n-Butanol	8.1±0.2	9.0±0.3	6.8±0.1	6.9±0.1	4.8±0.3	5.3±0.2	3.7±0.3	3.7±0.4	ND

LD_{50} (µg/insect), Values are mean±S.D. N=3, ND=not determined.

Toxic responses of various extracts from *C. dichotoma* were evaluated against Indian white termite *O. obesus.* For this purpose, insects were treated with increasing dose of both extracts separately. The mortality rate was found to be dose and time dependent as it was found to increase with an increase in dose and exposure period.

DISCUSSION

In present time, termite menace is a serious problem in tropical and subtropical regions. Indian white termite is a dreadful insect pest which causes economic damage to commercial wood, fibers, paper sheet, clothes, woolens, and mats and seriously infests agricultural crops and forest products. In the present study, we have tried to control termite infestation. Our results show that *C. dichotoma* solvent extracts possess enough antitermite potential. By applying very small dose of these natural products, orientation, movement, feeding, and tunneling behavior in termites were found to be significantly suppressed. In toxicity bioassays, *C. dichotoma* ethyl acetate extracts have shown very high lethality.

CONCLUSION

Many commercial termiticides are available in the market to combat the destructive termites but none are entirely natural. The main purpose of present work was to contribute to the development of

new termiticide from plant natural resource that may have better activity than synthetic termiticides and might be environmentally more acceptable than any other synthetic pesticide. No doubt, *C. dichotoma* possesses enough antitermite potential to control Indian white termite, *O. obesus* population. However, it can be concluded that *C. dichotoma* active components can be used for controlling the damage and termite infestation if used as spray, fumigant or in form of poison baits. Hence, strong recommendations are being made to develop eco-friendly antitermite formulation from *C. dichotoma* plant for effective control of field termites. Only 2% ethyl acetate extract exhibited excellent termite mortality. On the basis of the LD_{50}, the effect of 2% ethyl acetate extract against *O. obesus* termite was the most interesting. The obtained results may also provide a support to the uses of the plant in traditional termite control.

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