Evaluation Of Bio-Termiticidal Potential of *Datura Metel* L. Plant Extracts Against *Odontotermes Obesus* (Isoptera: Termitidae)

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Abstract- ***Indian white termite, Odontotermes obesus is most destructive polyphagous insect pest and damage to agricultural crops, forest goods and building materials. Therefore, the termiticidal effect of ethanol and aqueous leaves extract of Datura metel were evaluated against Indian white termites, Odontotermes obesus. The plant leaves were dried, powdered and extracted with ethanol and aqueous solvent in Soxhlet apparatus for 24 h. The 20 termites were exposed to various concentrations of ethanol (50, 100, 150, 200 and 250 ppm) and) aqueous (150, 200, 250, 300 and 350 ppm) plant extract of Datura metel. The percent mortality was recorded after 24 hrs. The termiticidal activity of leaves extract of Datura metel were (LD_{10}= 46.774ppm, LD_{50}= 120.23 ppm and LD_{90} = 251) in ethanol and (LD_{10}= 141.25 ppm, LD_{50}= 234.42 ppm and LD_{90} = 345.74) in aqueous leaves extract respectively. Results revealed that the mortality was increased with increasing in concentration of the plant extracts. The ethanol solvent extract of Datura metel showed higher termiticidal potential against Odontotermes obesus. Statistical variance, 95% confidence limits and regression equations are presented.***

Index Terms- ***Termiticide, Odontotermes obesus, Datura metel.***

I. INTRODUCTION

The Indian white termite, *Odontotermes obesus* Ramb is a very destructive polyphagous insect pest that burrows into enormous mounds and consumes cellulose material an almost anything which contains carbohydrate. The termites cause economic damage to trees, agricultural crops and wooden materials. The chemical pesticides are available to control termites. Due to their longer residual persistence and higher toxic effect, that harm the environment, humans and many beneficial organisms.

With a greater awareness of hazards associated with the use of synthetic pesticides there has been an increase need to explore suitable alternative method for termite control. Farmers use different plant material to protect their crops from termites. Natural products in their crude form or plant extract provide unlimited opportunities as termiticide. Plant derived pesticides are eco-friendly, non-toxic to non-target organisms, non-persistent in nature, besides they do not promote drug resistance (Liu *et al.* 2000).

Plants are rich sources of natural substances that can be utilized in the development of environmentally safe methods for insect control (Sadek, 2003). A broad range of plants are toxic, repellent, or have some antifeedant properties several of which were regarded as insecticides (Blaske and Hertel, 2001; Ganapaty *et al.,* 2004, Boulogne *et al.,* 2012; Raina *et al.,* 2012; Addisu *et al.,* 2014).

Owusu *et al*., (2008) evaluated the repellent and antifeedant activity of plants, *Ocimum canun, Ocimum gratissimum, Zanthoxylum xanthoxyloides, Sporobolus pyramidalis* and *Allium sativum* against the termites, *Macrotermes sp.*by choice and non-choice method.

Khayra *et al.,* (2021) examined the anti-termite potential of *Calotropis procera, Pergularia tomentosa, Datura stramonium* and *Hyoscyamus muticus* from southwest of Algeria on workers of the harvester termite, *Anacanthotermes ochraceus* by direct contact application.

Padwal *et a*l., (2023) examined the effects of fresh and fermented leaf extracts of sweet neem, tulsi, common lantana, neem congress grass, flower extract of

marigold and seed extract of jatropha at the concentrations of 5, 10, 15, and 17.5% w/v against worker termites of *Odontotermes sp.*

Datura reported to have antimicrobial activity (Rajesh and Sharma, 2002; Kaushik and Goyal, 2008).

Panneerselvam *et al*., (2013) evaluated the antifeedant and larvicidal effects of *Datura metel* L. leaf extracts against lepidopteran pest, *Helicoverpa armigera*.

Ibe *et al*., (2018) evaluated the toxicity and repellency of ethanol and aqueous extracts of *Azadirachta indica, Eucalyptus camaldulensis* and *Zingiber officinale,* at concentration of 10% and 20% against termites, Macrotermes. bellicocus under laboratory and field conditions.

Several plant species have been explored the potential for the management of termite. However, the local available plant parts will be more effective for the management of termites.

There are no reports available on the biological activities of *Datura metel* against Indian white termite, *Odontotermes obesus*.

The present study was conducted to evaluate the bio-termiticidal potential of local plant, *Datura metel* against white Indian termite, *Odontotermes obesus* at different concentrations.

II. MATERIALS AND METHOD

The leaves of *Datura metel* were collected from local area of Chhatrapati Sambhajinagar. The leaves were washed three times in tap water and rinsed with distilled water, the excess water was soaked and leaves were separated and dried in shade. The dried leaves material was powdered in domestic grinder and stored in air tight container in refrigerator till further use. From the stock 50 g of powdered was extracted with 1000 ml of aqueous and ethanol solvent using Soxhlet apparatus for 24 hrs separately.

Termites –
Odontotermes obesus were collected from nearby farms of Chhatrapati Sambhajinagar and brought to the laboratory. Traps were maintained in plastic jar containing moist soil. Active and healthy termites were used for the study within four days after field collection.

Termiticidal bioassay
The termiticidal effects of the plant extracts were tested on termites by using a 'no-choice' feeding test. Various concentration (50 to 350 ppm) of methanol and aqueous solvent extract of *Datura metel* were applied to Whatman No. 1 filter papers and allowed to air dry completely and were placed in petri plates under laboratory conditions. These treated filter papers were given as feed and 20 active termites, *Odontotermes obesus* were released in each experimental and control petri plates. Three replications were conducted. The percent mortality was calculated after 24 h and the observed data was subjected to probit analysis (Finney, 1947; Busvine, 1971). Filter paper treated with solvent alone was used as a control.

III. RESULTS

The bio-termiticidal effect of ethanol and aqueous leaf extracts of *Datura metel* was evaluated for the management of Indian white termite, *Odontotermes obesus.* The cumulative mortality of *Odontotemes obesus* were recorded after 24 hrs. at (50, 100, 150, 200, and 250 ppm) and *Datura metel* aqueous extract (100, 150, 200, 250, and 300 ppm) doses of ethanol and aqueous extracts of *Datura metel* respectively. The corrected mortality was calculated using Abbott's formula and the results are presented. The results revealed that the mortality increases with increase in concentrations. (Figure and Tables).

The results of probit analysis for the estimation of LD_{10}, LD_{50}, LD_{90}, variance, 95% confidence limits and regression equation at 24 h for the mortality of Indian white termite, *Odontotermes obesus* are presented in Table-2.

The termiticidal bioassay in ethanol solvent extracts, LD_{10} = 46.774 ppm, LD_{50} = 120.23 ppm and LD_{90} = 251.19 ppm and in aqueous extract of *Datura metel* was, LD_{10} = 141.25 ppm, LD_{50} = 234.42 ppm and LD_{90} = 345.74 ppm respectively. Among the various estimate of regression-based probit analysis, the $\chi 2$ values for the regression coefficients showed

homogeneity to the data.

Table 1

Percent mortality of Indian white termite, *Odontotermes obesus* treated with ethanol and aqueous leaf extracts of *Datura metel*.

Plant extract	Dose (ppm)	No. of insects used	Mortality after 24 hrs.	Cumulative mortality
Control		20	-	-
Ethanol Leaf Extract	50	20	03	15
	100	20	07	35
	150	20	11	55
	200	20	15	75
	250	20	18	90
Aqueous Leaf Extract	150	20	03	15
	200	20	07	35
	250	20	10	50
	300	20	14	70
	350	20	18	90

Table 2

LD_{10}, LD_{50} and LD_{90} values with variance, 95% confidence limits and probit analysis parameters for Indian white termite, *Odontotermes obesus* after exposed to extract of *Datura metel* after 24h.

Plant extracts	LD_{10} ppm	LD_{50} ppm	LD_{90} ppm	Variance	95% CL		Regression equations	χ^2 (Degree) of
					Lower	Upper		
Ethanol	46.774	120.23	251.19	0.1045	1.4464	2.7136	3.15426x-7.563733	1.3618
Aqueous	141.2	234.4	345.7	0.0297	2.032	2.707	5.8219x-8.8024	1.0336

FIG.-1

Regression and provisional lines for LD_{10} and LD_{50} values of *Odonototerms obesus* exposed to ethanol leaves extract of *Datura metel* after 24 h.

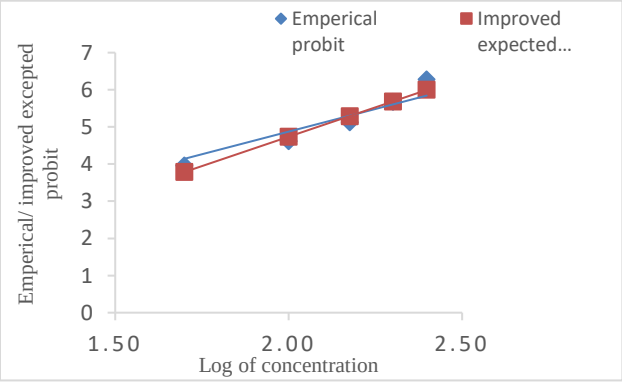
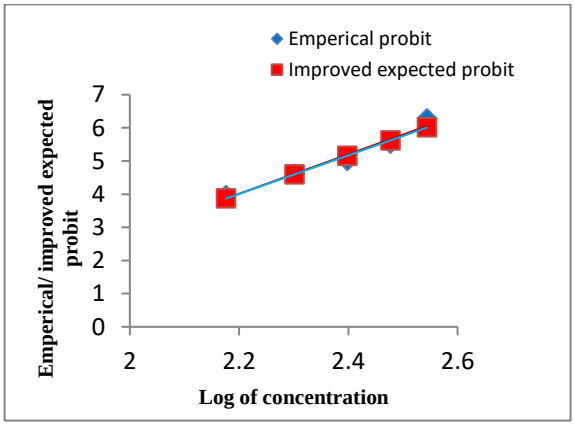


FIG.-2

Regression and provisional lines for LD_{10} and LD_{50} values of *Odonototerms obesus* exposed to aqueous leaves extract of *Datura metel* after 24 h.



IV. DISCUSSION

The Indian white termite, *Odontotermes obesus*, is a highly destructive insect that severely infests agricultural crops and forest goods in addition to causing economic harm to commercial timber, fibers, paper sheets, textiles, woolens, and carpets.

In this study, we used ethanol and an aqueous extract of the plant, *Datura metel* for the management of termite infestation. Our findings indicate that *Datura metel* has the potential to act as a bio-termiticide.
Mustaparta (2002) states that inappropriate plants are avoided by identifying additional chemical cues, which could be poisonous or repulsive to insects. This idea served as the foundation for the development of botanical pesticides, which are used to manage insect infestations. It has been observed that crude extracts from the leaves, stems, roots, and seeds of different plant species have growth-inhibiting, insecticidal, and/or anti feedant properties (Ekesi, 2000). The interaction of plant and insects frequently develop the special adaptations to find or choose the plants using chemical, optical, and mechanical cues (Schoonhoven *et al.,* 1998). Nazeer Ahmed et.al 2016 recorded the mortality rate at 20%, 10%, and 5% solutions of neem was 92.44%, 55.20%, and 32.80%, respectively after 10 days.

Patel and Narasimhacharya (2017 and 2024) reported the anti-termite potential of four plant species, *Achyranthes aspera*, *Sida acuta*, *Syzygium cumini* and *Terminalia arjuna* also isolated the termiticidal compounds from Lantana camara L. against *Odontotermes obesus*. The anti-termite potential of each extract revealed that among the plants examined, *T. arjuna* stem methanol extract exhibited the highest termiticidal potential (74.67%) followed by *S. cumini* leaf and stem methanolic extracts (70% ,67% respectively). Aqueous extract of *A. Aspera* was found effective against termites and exhibited 56% mortality over a period of 48hrs.

Ahmed *et al*., (2005) showed the comparative efficacy of *Datura alba Nees*, *Calotropis procera* and imidacloprid on termites in sugarcane.

Abbasipour *et al.,* (2011) evaluated the insecticidal activity of leaves extract of Datura stramonium (Family: Solanaceae) against *Callosobruchus maculatus* and estimated the lethal concentration to kill 50% of the population (LC_{50}) at 1680 and 16058 ppm, for 24 and 48h, respectively. Deshmukh and Borle (1975) reported the toxic effect of petroleum ether extract of *Datura alba* seed on *Dactynotus carthami*. Khalequzzaman and Islam (1992) reported the toxic effect of methanolic extract of *Datura metel*, *D.alba* and *D. fastuosa* against *Tribolium castaneum* and *Datura metel* leaf extract was more toxic than *D. alba* and *D. fastuosa*.

Addisu et al., (2014) evaluated the biotermiticidal effect of botanical extracts of *Azadirachta indica, Jatropha curcas, Maesa laceolata, |Chenopodium ambrosoids,* and *Vernonia hymenolepis* at 10, 20, 30 and 35% concentration against workers termites, Macrotermes spp. Under laboratory conditions.

Panneerselvam *et al.,* (2013) evaluated the biopesticidal effect of ethyl acetate leaf extracts of Datura metel L. against the larvae of *Helicoverpa armigera* (Hübner) and exhibited significant antifeedant and larvicidal potential, the ethyl acetate fraction (5.9, 19.3, 31.1, 38.5, 84.8 and 152.6) of leaf extract of *D. metel* showed highest larval mortality against I, II, III, IV, V and VI instar larvae of H. armigera respectively.

The finding of the present investigation revealed that, the leaves extract of *Datura metel* possesses remarkable termiticidal activity against *Odontotermes obesus*. The LD_{10} = 46.774 ppm, LD_{50} = 120.23 ppm and LD_{90} = 251.19 ppm in ethanol and LD_{10} = 141.25 ppm, LD_{50} = 234.42 ppm and LD_{90} = 345.74 ppm in aqueous leaf extract of *Datura metel* are recorded whereas ethanol solvent extract was more effective than aqueous extract of *Datura melet*. The study needs further investigation to find out active ingredients responsible for termiticidal properties of *Datura metel* and to reach any final recommendations.

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