PLANT EXTRACTIVES

TERMITE

ANTITERMITIC PROPERTIES OF SELECTED PLANT EXTRACTIVES AGAINST BUILDING INFESTING TERMITE *Microcerotermes beesoni*, SNYDER

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ABSTRACT

Laboratory experiments were conducted to evaluate leaves extract of *Lantana camara (Verbenaceae), Murraya koenigii (Rutaceae), Cassia occidentalis (Fabaceae), Nerium indicum (Rutaceae), Aegel marmelos (Rutaceae), Parthenium hysterophorus (Asteraceae); seed extract of Syzygium cumini (Myrtaceae), Cassia occidentalis (Fabaceae) and root extract of Hibuscus rosa sinensis (Malvaceae)* against building infesting termites *Microcerotermes beesoni*, Snyder. Termite culture was maintained in the laboratory at $28^0C \pm 2^0C$ and 90% ± 5% RH. Active and healthy termite workers were sorted out. Ten active workers were released on each treated Whatman filter paper (90 mm dia.) fitted inside glass petri dishes. Periodically, mortality of termites were observed after every two hours interval up to 24 hrs and compared with untreated filter papers. 100% termite mortality has been recorded with leaves extract of *L.camara* (in petroleum ether), ethanolic leaves extract of *M. koenigii* and methanolic seed extract of *C.occidentalis*, while termite mortality was observed less than 15% within 24 hours on untreated filter papers. Results of present study may be useful for development of herbal formulation for spot treatment in termite infested buildings and to overcome synthetic termiticides borne problems.

KEY WORDS: **Biopesticide, Termite management, Buildings, Plant extract.**

Introduction

Termites are highly successful group of true social insects, which is evidenced by their worldwide distribution. Out of more than 2700 species found in the world, 183 species are known to damage buildings. They enter into buildings unobserved through the foundations and spread to upper parts of structures through joints, floor and wall cavities etc. Termite cause severe damage to supporting structural timbers, flooring, paneling, window and door frames, furniture, books, fabrics, leather, carpets and lumber in storage etc. Termite management in buildings has not changed much in last three decades in India. Majority of professionals still rely on various kinds of termiticides (Rawat, 2004). On the other hand, termiticidal toxicity is a global concern now. Pesticidal toxicity was also reported even in house dust by Department of Public Health in California. The level of well known termiticide Chlorpyrifos was 74 ppb. It has been estimated that there are about 7,50,000 reported pesticide poisoning cases with about 13,800 deaths annually in the world (Harnly et al. 2009). On the other hand, plants are the richest source of secondary metabolites. These phytochemicals are nitrogen compound (like alkaloids, cyanogenic glycosides and glucosinolates), terpenoids and phenolics. Due to increasing concern about pesticidal toxicity in recent years, interest has been increased to search new alternatives of synthetic termiticides (Gupta, 1995; Nunes and Nobre, 2004; Owusu et al. 2008; Sakasegawa et al. 2003). Present paper is based on the termiticidal properties of certain plant extractives prepared in the laboratory.

Material and Methods

Leaves and seeds of locally available plants like- *Syzygium cumini (family-Myrtaceae), Murraya koenigii (family-Rutaceae), Lantana camara*

Table

Per cent mortality of termites of on filter papers treated with herbal extractives prepared in different solvents

Name of Plant	Plant Part	% Mortality (Mean+SD) of termites in different solvents			
		Acetone	Ethanol	Methanol	P. Ether
S. cumini (Myrtaceae)	Seeds	90 + 6.32	56.60 + 12.11	63.30 + 8.16	13.30 + 8.16
L. camara (Verbenaceae)	Leaves	96.60 + 5.16	86.60 + 5.16	80.00 + 6.32	100
M. koeinigii (Rutaceae)	Leaves	96.61 + 5.16	100	90.00 + 6.32	76.6 + 5.16
C. occidentalis (Fabaceae)	Seeds	86.6 + 5.16	81.00 + 4.08	100	80
C. occidentalis (Fabaceae)	Leaves	53.30 + 7.52	33.30 + 8.16	50.00 + 8.94	26.60 + 7.52
N. indicum (Rutaceae)	Leaves	50.00 + 7.52	26.60 + 10.48	23.30 + 8.16	33.30 + 8.16
A. marmelos (Rutaceae)	Leaves	46.60 + 12.11	20.00 + 6.32	30.00 + 6.32	70.00 + 12.64
H. rosa sinensis (Malvaceae)	Roots	6.66 + 5.16	6.66 + 5.16	10	6.66 + 8.16
P. hysterophorus (Asteraceae)	Leaves	16.60 + 5.16	13.30 + 5.16	11.30 + 5.16	1666 + 5.16
CONTROL	-	20.00 + 6.32	15.00 + 5.47	15.0 + 5.47	16.66 + 5.16

(family-Verbenaceae) and *Cassia occidentalis (family-Fabaceae)* were collected, chopped and dried in the shade. Later, fine powder was prepared with the help of laboratory grinder. Known quantity of each powdery material was used to prepare extracts. Extractives were prepared in different solvents like acetone, ethanol, methanol and petroleum ether and recovered from glass petri dishes in solid and semi solid form after evaporation of excess solvent in room temperature. Herbal solution of 1000 ppm (0.1%) concentration of each material was prepared and used in the experiment.

Carton nests of test termite (*Microcerotermes beesoni*, Snyder) were collected from the field and cultured in the laboratory. Termite population is variable in each nest depending upon shape and size of nest. Number of active workers is also variable, which ranges from 7000 to 45000 and depends upon the season of collection. Termite cultures were maintained in the laboratory in glass desiccators (O.D. 350mm-450mm) and experimental jars (capacity 2000 ml) filled with sterilized soil and chips of perishable Mango wood (*Mangifera indica*). Cultures were maintained at a temperature of $28^0C \pm 2^0C$ and 90% ± 5% relative humidity. Healthy and active termite workers were sorted out with the help of standard filter paper technique (Chang and Cheng, 2002; Chang *et al.* 2001; Cheng and Chang, 2002; Singh and Singh, 2009). Herbal solution of 1000 ppm concentration was applied on whatman filter paper (90 mm size). Six replicas of each plant extract were prepared and loading of extract was calculated .Treated filter papers were then fixed inside 90 mm Borocil glass petri dishes. Ten numbers of fresh and active termite workers were released on each dish in the laboratory at normal environmental conditions. Termite mortality was observed after every two hours interval up to 24 hrs. Later, it was compared with termite mortality on untreated and solvent treated (control) filter papers. Remaining plant extracts were stored in freezer at low temperature for further isolation, separation, fractionation, IR and NMR studies.

Results and Discussion

The herbal extractives, which have shown 90% to 100% termite mortality within 24 hours were-seed extract of *S. cumini* in acetone (90% ± 6.32 S.D.); leaves extract of *M.koiginii* in acetone (96.6% ± 5.16 S.D.), leaves extract of *M.koiginii* in ethanol (100%), leaves extract of *M.koiginii* in methanol (90% ± 6.32 S.D.); leaves extract of *L.camara* in acetone (96.6% ± 5.16 S.D.), leaves extract of *L. camara* in petroleum ether (100%) and methanolic seed extract *of C.occidentalis* (100%). Whereas termite mortality on untreated filter papers (control) was 11.6% ± 4.08 S.D., which was increased to 20% ± 6.32 S.D., when filter papers were treated with solvent only (Boue and Raina, 2003). (*Table-1, Fig.1-2*).

Spraying of toxic termiticides inside in-built environment of buildings are major source of "*Sick building syndrome*" . Therefore, it should be avoided as far as possible to control toxicity level and

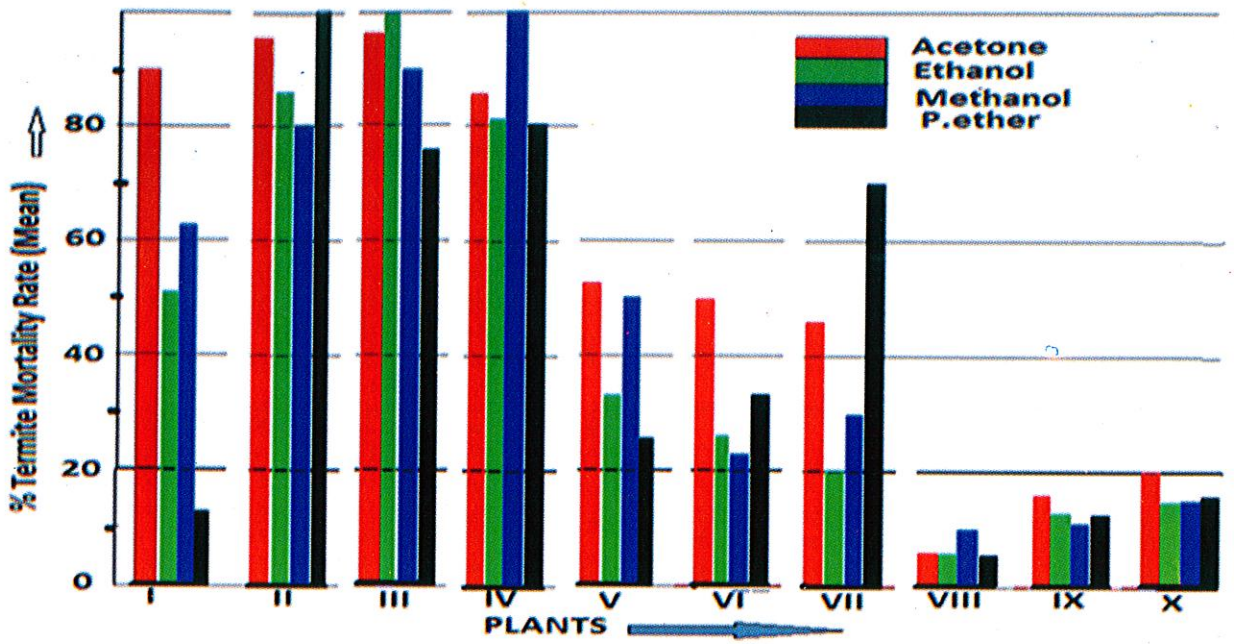

Fig. 1: Graphic representation of results.

Plant-II **Plant-III** **Plant-IV**

Fig. 2: Leaves of L. camara (Plant-II), M. koeinigii (Plant-III) and seed of C. occidentalis (Plant-IV).

maintaining building hygiene (Handa, 2004). Earlier, Sohail *et al.* (2007) has also studied seed extract of *Withania somnifera, Croton tiglinum* and *Hygrophila auriculata* on behavior and physiology of *Odontotermes obesus* (Isoptera, Termitidae), Blaske and Hertal (2001) and Blaske *et al.* (2003) has experimented on repellent effect of isoborneol on subterranean termites in soils of different composition. Park and Shin (2005) has studied fumigant activities of plant essential oils and components from *Allium sativum* and *Eugenia caryophyllata* oils against termites. Rupal *et al.* (2008) has recorded termiticidal properties of certain weed plants. Antitermitic and antifungal activities of essential oil of *Calocedrus formosanus* leaf and its composition were investigated by Sen-Sung Cheng, *et al.* (2004) and Zhu *et al.* (2001) evaluated vetiver oil and seven insect-active essential oils against Formosan subterranean termites.

In conclusion, herbal termiticidal solution have good scope for spot treatment to check further spreading of existing termite infestations in buildings and to keep toxicity at minimum level but their application as soil termiticide still need more detailed investigations. Results of present study are encouraging and may be useful to overcome

synthetic termiticides borne problems and development of potential natural termiticide for buildings (Rawat, 2012).

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