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Insecticidal Activity of *Prosopis Juliflora* Seed Oil against Termite (*Odontotermes obesus*) and Cockroach (*Blattella germanica)*

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Abstract
Plant produces large number of compounds as secondary metabolites with complex structure and diversity with a potent insecticidal activity. Large number of plants has been identified so far for their insecticidal property and can be used as an alternative pest management for synthetic pesticides. The present investigation was conducted to evaluate the insecticidal activity of *prosopis juliflora* against termite (*Odontotermes obesus*) and cockroach (*Blattella germanica)*. The n-hexane extract of the proposed plant showed higher percentage mortality at 10 % concentration in 30 and 42 hours against termite and cockroach respectively. The LD_{50} was determined to be 0.472% and 1.07% for termite and cockroach, respectively after 23 hours. The proposed plant showed significant insecticidal activity at 0.005% level of confidence. From the present investigation it can be suggested that *prosopis juliflora* can be used as potential insecticide.
Keywords: Insecticidal**,** *prosopis juliflora,* Bio-degradable

1. Introduction

Plant produces large number of compounds as secondary metabolites with complex structure and diversity. Secondary plant metabolites play a key role in plant defense against insects and pathogens (Solanki and Shanker, 2001**;** Bakkali *et al*., 2008). It can also be used to produce bio-insecticide with so many advantages over synthetic herbicides (Arnason *et al*., 1989). Insecticidal activity of different plants against several insects has been discovered so far (Jilani and Su, 1983**;** Carlini and Grossi-de-Sá, 2002). The insecticidal activity of the plant can be manifested in different manners including toxicity, mortality, antifeedant, growth inhibitor, suppression of reproductive behavior and reduction of fecundity and fertility (Yang and Tang, 1988).

Now a day replacing synthetic insecticide with plant based insecticide is a great concern as synthetic insecticides are toxic to nun target organisms including animals and humans. Utilization of synthetic herbicide frequently might also results in the development of insect strains resistant to insecticides (Zettler and Cuperus, 1990; Riebeiro *et al*., 2003). Synthetic insecticides are not bio-degradable and its persistence in the soil and water results in water and soil pollution. Plant based insecticide is safe, economical and environmentally sound and can be a potential replacement for synthetic insecticides. There are various plants identified for the potent insecticidal activity viz., *Peganum harmala*, *Ajuga iva*, *Aristolochia baetica Raphanus raphanistrum* (JBILOU *et al*., 2006), *Chrysanthemum coronarium*, *Chrysanthemum myconis*, *Chrysanthemum fuscatum*, *Chrysanthemum paludosum*, *Chrysanthemum trifurcatum*, *Chrysanthemum grandiflorum*, *Chrysanthemum segetum* (Haouas *et al*., 2008), *Chromolaena odorata* (Udebuani *et al*., 2015), *Rhazya stricta Decne, Lantana camara, Ruta chalepensis, Heliotropium bacciferum Forssk* (Alshehry *et al*., 2014), *Achyranthes aspera* (Jeyasankar *et al*., 2014), *Mantisalca duriaei, Rhaponticum acaule, Scorzonera undulate, Scorzonera undulate* (Boussaada *et al*., 2008), *Azadirachta indica, Curcuma longa, Justicia adathoda, Lantana camara, Ocimum tenuiflorum, Vitex negundo* (Rejitha *et al*., 2014).

Prosopis juliflora commonly known as "mesquite" is an evergreen perennial tree that can grow in arid and semi-arid regions. It is fast growing nitrogen fixing plant and capable of adapting harsh environments as deserts and saline soils. It is widely distributed in different parts of the world including Australia, Mexico, South America, South and East Africa, Kuwait, India and Ethiopia (Sato, 2013; Pasiecznik and Nick, 1999**,** Yemata, 2014). Numerous bioactive chemical constituents including polyphenols, flavonoids, tannins, saponins, alkaloids, terpenes, cyclopentanones and others have been isolated from different parts of *Prosopis juliflora* (dos Santos *et al*., 2013**,** Ibrahim *et al*., 2013**;** Singh, 2012, Dadi *et al*., 2015). Some of the bioactive components extracted from *Prosopis juliflora* have insecticidal property. The aim of the present study is also to evaluate the insecticidal activity of the n-hexane extracts from *prosopis juliflora* against termite (*Odontotermes obesus*) and cockroach (*Blattella germanica).*

2. Materials and Methods

2.1 Plant Collection and preparation

The seed of *prosopis juliflora* plant used for the present study were collected from Arbaminch, Ethiopia. The seeds of the test plant were manually separated from the pods and cleaned to remove all foreign matter. After which the separated seed was sun dried and then powdered using grinding mill. The powdered sample were sieved and preserved for the next procedure.

2.2 Extraction

About 30 g of finely grounded seed of the test plant were used to extract the essential oil in 250 mL of n-hexane by using soxhlet extraction for about three hour. Then, the solvent was separated from the oil by using Rota evaporator and suction pump. The extracted phase was distilled to separate the oil from the solvent and the distillate were collected and stored in a refrigerator for further experiment.

2.3 Biopesticidal Activity of *Prosopis Juliflora* Extract

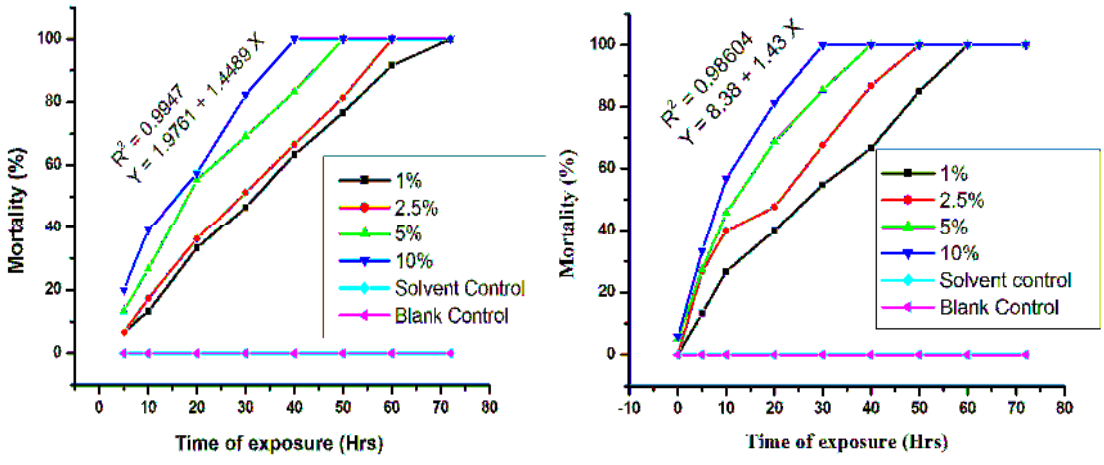
The two types of insects, termite (*Odontotermes obesus*) and cockroach (*Blattella germanica)* identified for the present study were collected from Arbaminch, Ethiopia. The collected insect were brought to the laboratory and acclimatized for about 24 hours. Each batch of insects, held in a rigid polythene container with a mesh lid, was transferred to the test room maintained. An l0 mL plastic beaker containing cotton wool soaked with l0 mL water was inverted on the mesh to provide a water source for the insects. Hence, each time oil samples of 1, 2.5, 5 and 10 % oil solution in 20 % of ethanol was made and 1mL of the solution was taken in testing Jars/Petri dish. Food or water was given during the test period after every count. After the insects had recovered, knockdown counts will be recorded every 5 hours. Then, modified bioassay method was employed to evaluate the biocidal activity of *prosopis juliflora* oil.

2.4 Statistical Analysis

The percentage mortality was calculated from the data collected and analyzed statistically using SPSS version 16 (SPSS Inc., Chicago, IL, USA) and Origin 6. One-Way Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) for mean comparison between values of the treatment was used. The data obtained was done in triplicates and results with $p < 0.05$ were considered to be statistically significant.

3. Results and Discussion

Plant metabolizes various compounds as a secondary metabolite with structural diversity and complex nature. Plant synthesizes these chemicals for various purposes where utilization as a protective agent against insects and pathogens can be pointed. In the present study the insecticidal activity of crude extract of *prosopis juliflora* against termite (*Odontotermes obesus)* and cockroach (*Blattella germanica)* was studied. The percentage mortality of termite and cockroach were calculated after treatment of the insect with the plant extract. The percentage mortality of cockroach were analyzed and given in Figure 1a. As it can be understood from the result, the percentage mortality of cockroach increased with increase in concentration and time of exposure. The highest mortality for cockroach was recorded at a concentration of 10 %. At this concentration the cockroach encounters death within 42 Hrs. The LD_{50} was determined to be 1.07 %. The recorded insecticidal activity of the plant extract showed statistical significance ($p < 0.05$) for each concentration (1 %, 2.5 %, 5 % and 10 %) compared to control.



a **b**

Fig 1: Plot of percentage mortality of a) cockroach vs. time b) termite vs. time with different concentration of *prosopis juliflora* seed oil.

The percentage mortality of adult termite (*Odontotermes obesus*) exposed to different concentration of plant extract was presented in Figure 1b. The percentage mortality of termite increased with increase in concentration and time of exposure. The highest mortality for cockroach was recorded at a concentration of 10 %. At this concentration the termite encounters death within 30 Hrs and the LD_{50} was determined to be 0.472 %. The insecticidal activity of seed extract of *prosopis juliflora* showed statistical significance ($p<0.05$) for each

concentration (1 %, 2.5 %, 5 % and 10 %) compared to control. The percentage mortality of termite and cockroach at a concentration of 10 % were compared and the result was presented in Figure 2. *Prosopis juliflora* showed better insecticidal activity against termites compared to that of cockroach.

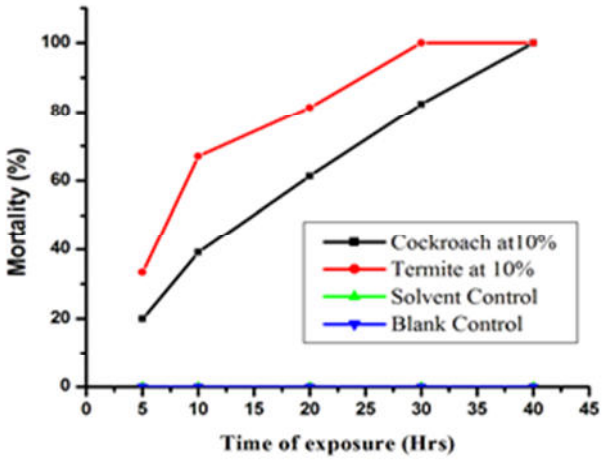


Fig 2: Comparative plot of percentage mortality of cockroach and termite vs. time with 10% of *prosopis juliflora* seed oil

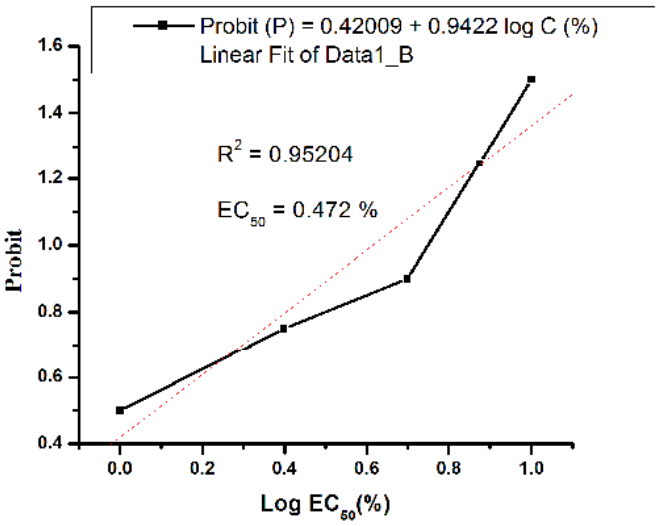


Fig 3: Plot of Probit vs. log C (%) for *prosopis juliflora* oil to termite workers after 30 hrs. exposure.

There are different reports supporting the present investigation about pesticidal property of *prosopis juliflora.* Rawat and Srivastava (2012) investigated the insecticidal activity of extract from different parts of *p. juliflora* against *Callosobruchus Chinensis*. In that report a significant mortality of the insect up to 66.67 % was reported. Pugazhvendan *et al*., (2012) also reported the insecticidal potency of *prosopis juliflora* plant extract against *tribolim castaneum*.

4.0. Conclusion

Plant produces different chemicals as secondary metabolites which help them to defend themselves from insects and others organisms. Secondary plant metabolites can also be extracted and used as controlling devise against insects as cockroach and termites. In the present study the n-hexane extract of *Prosopis juliflora* showed a significant insecticidal activity against cockroach and termites. Hence from this prospective it might be suggested that the proposed plant can be used as an alternative method to control insects. But further investigation must be performed to fully understand the chemistry and mechanism behind.

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