

Effect of Cedar Extract (*Cedrela odorata* L.) on the Termite (*Reticulitermes* spp.)

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Abstract

For knowing the effect that causes the extract from the leaves of the cedar (*Cedrela odorata* L.) in termites (*Reticulitermes* sp.) that affecting rooms, libraries, racks, fence posts and all articles wood source, considering the hypothesis that the extract from the leaves of the cedar is a substance that it makes termites die at a certain time, which makes it possible to use the extract as a biological insecticide that does not harm the environment and influencing the sustainable management of the rooms and many articles wood source. Termites were reared in a greenhouse in susceptible consumption and suitable for reproduction wood, of where the termites were collected and placed in petri dishes together with the remains of wood that contained. The application of the extract was done with a manual atomizer, sprinkling it on termites and wood waste, using 20 mL per petri dish and then counted the seconds until termites immobilized or dead in a 100%. Cedar extract acted as insecticide on termites but of all doses tested 5.0 g of leaves per 500 mL of water was the that caused the termites died in a few seconds after application under laboratory conditions.

Keywords

Leaves Trituration, Extract Dose, Termites Death, Sustainable Control

1. Introduction

Red cedar (*Cedrela odorata* L.) is a species that is primarily located in humid ecosystems, specifically in the evergreen tropical forest, sub-deciduous tropical forest, tropical deciduous forest and in the mesophilic mountain forest [1]. Red cedar is characteristic of rainforests of economic and ecological importance, but

the lack of quantitative studies that explain the characteristics of the seeds of this species have been some of the causes that limit its cultivation and propagation [2]. However, Ramírez *et al.* [3] have mentioned that due to the survival, growth in height and diameter, health and vigor of an evaluated plantation, red cedar has a good adaptation in the south of Tamaulipas, Mexico, which allowed them to affirm that the establishment of commercial forest plantations of cedro is a viable option for reconvertng abandoned agricultural land in the region.

In Cuba, cedar (*Cedrela odorata* L.) is grown on large-scale commercial plantations, and peasants use the infusion of their leaves to relieve tooth and ear pain, while the stem is used as an antipyretic and abortifacient. In addition, as general uses, their use is cited for the relief of vomiting, indigestion and hemorrhage control, among others [4]. The same authors report that of the plant extracts evaluated against bacterial strains, the highest antibacterial activity was observed with the extract elaborated from the foliage of *Tectona grandis* L. f. and *Cedrela odorata* L. wood, with activity on 50% of the bacterial strains evaluated.

In the state of Hidalgo, Mexico, cedar (*Cedrela odorata* L.) develops mainly in the windward zone, which comprises the portion of the coastal plain of the gulf, the east flank of the slopes of the Sierra Madre Oriental and the canyons which lead to the coastal plain [5].

A particularly insidious pest of wood is the termite, whose predilection for a diet of this type of material leads to the most surprising invasions of rooms, bookcases, frames, fence posts and any article of wood origin, such as paper, cardboard, boxes, books, among others. Termites avoid exposure to air, rarely seen, until they have done great damage. Living in the earth they make an opening to the interior, so that they are in contact with the soil and from that small entrance they excavate a passage of communicating channels, always working inside the invaded opening, without breaking the surface, until the wood is so weakened that it breaks before the occupants are aware that an enemy has been working under their feet [6]. The subterranean habit of the termite makes detection difficult and allows them to expand through wide expanses under the soil. In addition, they can access wood surfaces away from the ground through the construction of tunnels on walls of any building material [7].

Termites are relatively small insects (between 3 and 10 mm) and live in associations made up of different breeds, being the juveniles from the second molt onwards, with the exception of soldiers, the who perform the galleries on the wood they attack. They are longevy species of biological cycle complex and singulars relationships among individuals, such as: secretion of alarm and aggregation pheromones, trophictic feeding, cannibalism, necrophagia, oophagia and noise emission [7].

The species of the genus *Reticulitermes* are the biggest plague that is infesting structures in numerous countries of the world. It is estimated that, in the United States alone, termites cause over three trillion dollars annually in structural tim-

ber damage, of which 80% is attributable to subterranean termite [8].

The objective of the research was to determine the effect of cedar (*Cedrela odorata* L.) extract on termites (*Reticulitermes* spp.) affecting rooms, bookcases, frames, fence posts and all articles of origin of wood.

2. Materials and Methods

The experiment was carried out in the laboratory of the Technological University of Culiacán, located at km 2.0 of the Culiacán-Imala highway, in the Educative Sustainable Educating City, Los Angeles colony of Culiacán Rosales, Sinaloa, Mexico, with coordinates 24°50'30"N and 107°50'30"E, with a height of 58 meters. According to Garcia [9], the climate is B₁S₁, semi-arid with rains in summer and winter and 670 mm of annual precipitation. The average annual temperature is 24°C, with maximum temperatures of 41°C in summer and minimum temperatures of 5°C in winter, and 66.6% average annual relative humidity.

The termites were grown in the chapel-type greenhouse of the university, as shown in **Figure 1** and **Figure 2**, inside of wood susceptible to consumption and adequate for they reproduction, of where which the termites were collected and placed in petri dishes together with some residues of the wood that contained them.

The extract was obtained after drying the leaves and crushing them with the blades of a blender, from which samples of 3, 4 and 5 g were taken and then deposited in the blender jar to be processed in 500 mL of water by further grinding, until obtain the substance with the extracted of the vegetal tissue. Subsequently the extract was decanted on a blanket canvas that allowed the separation of the vegetal remains; the resulting substance was the one used to apply it on the termites.

The application of the extract was done with a hand atomizer, sprinkling it on the termites and the wood residues, applying 20 mL per petri dish and later



Figure 1. Termite breeding in wood susceptible to consumption.



Figure 2. Another aspect of the termite breeding in wood.

counted the seconds elapsed until the termites were still or dead in 100%.

3. Results and Discussion

When the cedar extract was applied at a concentration of 3 g per 500 mL of water, the termites died in 25 seconds, while when applying extract obtained from 4 g of leaves the termites died at the end of 20 seconds. However, when the termites were sprayed with the extract obtained from 5 g of leaves, they died in a time of 7 seconds.

The analysis of variance with respect to the time that the termites took to die after the application of the cedar extract, yielded a standard deviation (S) equal to 4.7 seconds in the first experiment, 4.6 in the second and 4.5 in the third, with probability of committing error (Pr) of 0.0001 in all three cases. However, in **Table 1** it can be observed that when the termites were sprayed with the extract obtained from 5 g of cedar leaves, in the first experiment, they died 18 seconds before those that were treated with extract elaborated with 3 g of leaves and 13 seconds before those who received the extract obtained with 4 g of leaves; while termites that were only sprayed with water did not die.

In the second experiment the results were similar, since with the extract obtained with 5 g of leaves, the termites died 18 seconds before those that were handled with extract from 3 g of leaves and 13 seconds before those that received the extract obtained with the 4 g of leaves; termites that only received water did not die either.

The results of the third experiment confirmed that observed in the first two, since with the extract elaborated with 5 g of leaves the termites died 19 seconds before those treated with extract from 3 g of leaves and 14 seconds before those that were sprayed with the extract obtained with 4 g of leaves; in this experiment neither death of the termites that only received water was observed.

These results indicate that, effectively the red cedar (*Cedrela odorata* L.) is a

Table 1. Dose of red cedar leaves per extract and time at which termites died in the petri dishes placed in the laboratory.

Treatments (g per extract)	Experiment 1 Time at morir (s)	Experiment 2 Time at morir (s)	Experiment 3 Time at morir (s)
3	25 b	24 b	25 b
4	20 b	19 b	20 b
5	7 c	6 c	6 c
Control (water)	52 a (termites alive)	57 a (termites alive)	58 a (termites alive)
DMSH	10.2	10.5	9.9
CV	16.9	18.7	16.5

Averages with the same letter in the column are statistically equal (Tukey, $\alpha \leq 0.05$).

species that produces some type of substance that is toxic to the termites, which in turn is related to the reported by Rojas and Rodríguez [4], since these authors have reported that cuban peasants use the infusion of their leaves to relieve the pain of teeth and ears, while the stem used as an antipyretic and abortive. In addition, as general uses, its use is cited for the relief of vomiting, indigestion and control of bleeding, among others. The same authors report that of the plant extracts evaluated against bacterial strains, the highest antibacterial activity was observed with the extract elaborated from the foliage of *Tectona grandis* L. and *Cedrela odorata* L. wood, with activity on 50% of the bacterial strains evaluated.

In addition, they coincide with those of Carter *et al.* [10], Carter *et al.* [11], Carter *et al.* [12] and Scheffrahn [13], since these authors mention that there are woods that are characterized by their natural resistance to the attack of termites, which is mainly due to the presence of toxic and/or termite repellent secondary metabolites, commonly called extractives, on walls and cell lumens.

The results of this research are also related to those of Reyes *et al.* [14], since the death of the termites occurred within a few seconds after the application of the red cedar extract, so that the termite response may be due to the substances that give resistance to the cedar wood, which is a character that these authors discovered in the woods of the high jungle perennifolia, which is part of the species that occupies us, which makes them more resistant than those of pine and oak forest.

The results of the bibliographical research indicate that the red cedar can be found in 20 states of the 32 that integrate to Mexico; likewise, in several countries of the world, reported by Andrade and Solis [15], so that of natural form is have available are sufficient resources to produce this type of extract that causes the effects reported to alleviate discomfort in people or as an antibacterial substance, according to Rojas and Rodríguez [4], as well as to control termites of the species reported here, as long as they find the effective way to apply it to protect the origin resources wood, either within the soil surface or outside of it.

4. Conclusion

The extract of red cedar acted as insecticide on the termites (*Reticulitermes* sp.),

but of all the doses tested, that of 5.0 g of leaves per 500 mL of water was what caused the termites to die in very few seconds after application under conditions of laboratory.

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