Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2024; 12(3): 238-240

Received: 07-04-2024
Accepted: 10-05-2024

Fardin Rahman Saikia
Department of Zoology, D.K. College, Mirza, Assam, India

Priyanka Kalita
Department of Zoology, Pandu College, Guwahati, Assam, India

Corresponding Author:
Fardin Rahman Saikia
Department of Zoology, D.K. College, Mirza, Assam, India

Comparative evaluation of bio efficacy of Neem (*Azadirachta indica*) and Tulsi (*Ocimum tenuiflorum*) extracts in controlling termites

Fardin Rahman Saikia and Priyanka Kalita

DOI: https://doi.org/10.22271/j.ento.2024.v12.i3c.9337

Abstract
Chemical pesticides, widely used since the introduction of DDT, pose significant risks to human health and ecosystems. To address these concerns, there is growing interest in natural alternatives such as plant-based pesticides. This study evaluates the efficacy of aqueous extracts from Neem (*Azadirachta indica*) and Tulsi (*Ocimum tenuiflorum*) against *Odontotermes obesus* termites, significant pests causing economic damage to structures. Neem and Tulsi leaves collected were processed into aqueous solutions at concentrations of 0.25, 0.5, and 0.75 mg/ml. Termites were collected and housed under controlled conditions, and mortality rates were monitored over 72 hours after exposure to the extracts. Data analysis revealed concentration-dependent mortality, with Neem extract inducing 100% mortality at 48 hours (0.75 mg/ml), and Tulsi extract achieving similar results at 72 hours (0.75 mg/ml). LC50 values indicated Neem's slightly higher potency at 72 hours (0.2 mg/ml) compared to Tulsi (0.25 mg/ml). These findings underscore the potential of Neem and Tulsi extracts as effective biopesticides against termites, highlighting Neem's rapid action and potency over extended exposure periods.

Keywords: Plant-based pesticides, neem, tulsi, termites etc.

Introduction
Chemical pesticides have been extensively utilized since the introduction of DDT by Paul Hermann in 1939 (Abubakar *et al*., 2020) [1]. While effective at controlling pests, these chemicals pose significant risks to human health and biodiversity, accumulating in organisms across ecosystems and through food chains (Wilkinson *et al*., 2000) [9]. To mitigate these concerns, global efforts are underway to reduce reliance on synthetic pesticides by implementing integrated pest management (IPM) strategies and exploring alternatives such as plant-based pesticides.

Termites represent a major economic threat, causing substantial damage to man-made structures including timber in buildings, furniture, and other organic materials (Tagbor, 2009) [8]. Historically, persistent organochlorinated hydrocarbon insecticides were widely used for termite control, but their adverse effects on health and the environment led to global bans (Thomas *et al*., 2022) [11]. The prolonged use of synthetic termiticides has exacerbated environmental issues, underscoring the urgency to seek natural alternatives, such as plant-derived compounds (Xie *et al*., 2013) [10]. Numerous plant species have been investigated for their potential in termite control, leveraging secondary metabolites like alkaloids, terpenoids, and essential oils known for their anti-feedant and insecticidal properties (Addisu *et al*., 2014; Pettersen, 1984) [2, 6]. Therefore, this study aims to evaluate the efficacy of readily available plant extracts for termite management.

Materials and Methods
In the current study, two aqueous botanical extracts were prepared using: Neem (*Azadirachta indica*) and Tulsi (*Ocimum tenuiflorum*). Neem and Tulsi leaves were collected from various locations in Nalbari, Assam, India. After drying the leaves for 4 – 5 days under sunlight, they were ground into a fine powder using a mixer. Solutions of 100 ml were then prepared by mixing 25 mg, 50 mg, and 75 mg of the powdered material with distilled water, resulting in concentrations of 0.25, 0.5 and 0.75 mg/ml.

Odontotermes obesus termites were collected from a mound in Nalbari District using an aspirator. The termites were identified based on morphological charateristics using the keys given by Roonwal and Chhotani (1989) [7], Chhotani (1997) [4] and Bose (1999) [3]. The collected termites, known for their destructive behavior, were housed in plastic containers with mound soil and a moist tissue paper to maintain humidity (Addisu *et al*., 2014) [2]. For the experiment, 20 worker termites were transferred and placed in each of 7 different containers, each containing wet tissue paper for humidity control.

The aqueous extracts at different concentrations (treatment groups) were sprayed into each container, and termite mortality was observed at intervals of 12, 24, 48, and 72 hours. A separate container was placed and sprayed with distilled water, which became the control group. Mortality percentage was calculated by using the formula –

$$\frac{\text{No of deaths of workers of termites}}{\text{Total number of workers of termites (20)}} \times 100$$

Data analysis was done using M.S Excel 2007.

Results and Discussion

From the present study significant differences in termite mortality rates were observed between treatment groups (Neem and Tulsi) compared to the control group, which consistently showed 0% mortality throughout the experiment. Notably, at 48 hours and a concentration of 0.75 mg/ml, Neem extract induced 100% termite mortality. Similarly, 100% mortality was observed at 72 hours with the 0.75 mg/ml concentration of Tulsi extract. The lowest mortality percentage observed was 15% at 12 hours with Tulsi extract, and the second lowest was 20% at 12 hours with Neem extract at a concentration of 0.25 mg/ml. There was a clear dose-dependent effect observed, where an increase in extract concentration led to higher mortality rates (Table 1).

The LC50 values, representing the concentration of extract lethal to 50% of the termite population, were calculated to assess the effectiveness of Neem and Tulsi extracts over different time intervals (Table 2). At 72 hours, the smallest LC50 value was found for Neem extract (0.2 mg/ml), followed by Tulsi extract (0.25 mg/ml). At 48 hours, both Neem and Tulsi extracts showed similar LC50 values of 0.3 mg/ml. There was no significant difference in LC50 values between Neem and Tulsi extracts at shorter time periods.

The results demonstrate that both Neem and Tulsi extracts have significant insecticidal activity against *Odontermes obesus* termites. Neem extract exhibited slightly higher potency with a lower LC50 value at 72 hours compared to Tulsi extract, indicating its faster action or higher toxicity against the termites over a longer exposure period.

The dose-response relationship observed underscores the importance of concentration in determining the efficacy of botanical extracts as biopesticides. Higher concentrations led to more rapid and complete termite mortality, as evidenced by the 100% mortality rates observed at the highest concentrations and longest exposure times. Overall, these findings suggest that Neem and Tulsi extracts have potential as effective alternatives for termite control, particularly Neem extract which showed the ability to potentially eliminate termite populations with prolonged exposure.

Table 1: Effect of plant extract on termite mortality.

Mortality percentage at different time intervals					
Botanical extract	**Concentrations (mg/ml)**	**12hrs**	**24 hrs**	**48hrs**	**72 hrs**
Neem extract	0.25	20%	30%	45%	75%
	0.5	35%	50%	65%	90%
	0.75	65%	90%	100%	100%
Tulsi extract	0.25	15%	25%	45%	60%
	0.5	30%	50%	70%	85%
	0.75	70%	85%	90%	100%
Control Group	0	0%	0%	0%	0%

Table 2: LC 50 values at different time period.

Botanicals	Time Period (hrs)	LC 50 values (mg/ml)
Neem extract	12	0.63
	24	0.39
	48	0.3
	72	0.2
Tulsi extract	12	0.6
	24	0.41
	48	0.3
	72	0.25

Conclusion

From the current study it has been concluded that Neem extract showed slighlty higher potency at 72 hours showing the value of LC50 of 0.2mg/ml. Although Tulsi extract showed slightly lower potency in comparison, both extracts present viable alternatives to synthetic termiticides.

The neem extract of 0.75mg/ml concentration also showed a faster mortality rate compared to other concentrations doses.

References

1. Abubakar Y, Tijjani H, Egbuna C, Adetunji CO, Kala S, Kryeziu TL, *et al*. Pesticides, history, and classification. In: Egbuna C, Sawicka B, editors. Natural Remedies for Pest, Disease and Weed Control. Amsterdam: Academic Press; c2020. p. 29-42.
2. Addisu S, Mohammed D, Waktole S. Efficacy of Botanical Extracts against Termites, *Macrotermes* spp., (Isoptera: Termitidae) Under Laboratory conditions. Int J Agric Res. 2014;9:60-73.
3. Bose G, Zoological Survey of India. Termite fauna of North Eastern India: Vol. Occasional Paper. Zoological Survey of India; c1999.
4. Chootani OB. Fauna of India (Z. S. of I. Directors, Vol. 2). Zoological Survey of India; c1997.
5. Mekha T, Gayathri S, Athira KP, Roshini Susan Elias, Soumya S, Kurian P. Efficacy of plant leaf extracts on termites under laboratory conditions. J Entomol Zool Stud. 2023;11(1):106-110.
   DOI: 10.22271/j.ento.2023.v11.i1b.9131.
6. Pettersen RC. The Chemical Composition of Wood. In: Rowell RM, editor. The Chemistry of Solid Wood. Madison: American Chemical Society Washington DC, USA; c1984. p. 57-126.
7. Roonwal ML, Chhotani OB. Fauna of India (Z. S. of I. Directors, Ed.; Vol. 1). Zoological Survey of India; c1987.
8. Tagbor AT. The anti-termite properties and basic phytochemicals of eight local plants and the chemical characterisation of *Thevetia Peruviana* (Pers) K., Schum in Ghana. PhD Thesis; c2009. p. 12-17.

9. Wilkinson CF, Christoph GR, Julien E, Kelley JM, Kronenberg J, McCarthy J, *et al*. Assessing the risks of exposures to multiple chemicals with a common mechanism of toxicity: how to cumulate? Regul Toxicol Pharmacol. 2000;31:30-43.
10. Xie Y, Huang Q, Lei C. Bioassay-guided isolation and identification of antitermitic active compound from the leaf of Chinese cedar (*Cryptomeria fortunei* Hooibrenk). Nat Prod Res. 2013;27(22):2137-9.
11. Thomas JR, Martin P, Etnier JL, Silverman SJ. Research methods in physical activity. Human kinetics; c2022 Apr 28.