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REPELLENT SCREENING OF LINALOOL AN ESSENTIAL OIL-BASED NATURAL TERPENE COMPOUND AGAINST *PERIPLANETA AMERICANA* NYMPHS

Botany

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ABSTRACT

American cockroaches (Periplaneta americana) are one of the most devastating pests in urban settings. These are synanthropic in nature and transmit various pathogenic diseases and indoor allergy in the human environment. Furthermore, these developed metabolic resistance to synthetic insecticides, which have caused adverse effects on humans and the environment. This alters the research, increasing the demand for natural insecticides. Plant-derived natural volatile terpenes are emerging as insecticides with minimal mammalian toxicity. In this context, linalool showed effective insecticidal properties. The present investigations screened the repellent activity of pure linalool (97%) against the early nymphal stage of *P. americana.* Different concentrations were applied, and at the highest concentration, significant repellent activity was observed. The present study showed that natural terpenes can serve as valuable bioinsecticide agents for the management of American cockroaches.

KEYWORDS

Periplaneta americana, Synanthropic, Linalool, Repellent activity, Bioinsecticide

INTRODUCTION

Periplaneta americana (Blattidae) is one of the major urban pests found everywhere in houses, farms, hospitals, and residential areas [1]. Due to their higher adaptability and reproducibility, these act like mechanical vectors. Additionally, these transmit more than 100 pathogenic microbes, such as *Staphylococcus aureus*, *Aspergillus niger*, and *Entamoeba histolytica* [2]. Furthermore, these develop resistance to the most conventional insecticides [3]. Based on previous findings, synthetic insecticides can cause poisoning in humans and other non-target organisms [4].

Natural terpenes present in essential oils (EOs), such as eucalyptol, eugenol, thymol, and linalool, highlighted the synergistic and antagonistic insecticidal properties previously reported by the workers [5]. Among them, linalool showed the insecticidal potential against adult fruit flies [6].

Based on the above considerations, the present experiment was conducted using linalool, an EO-based natural terpene compound, to screen its repellent activity against the early nymphal stage of *P. americana*. Statistical analysis was done using Prism 10.4.2.

MATERIALS AND METHODS

Mass rearing of *P. americana* was done under standard laboratory conditions. The temperature was 28°C, with 60%-70% humidity. A bread slice and water were also provided under a 16:9 photoperiod to maintain the colony.

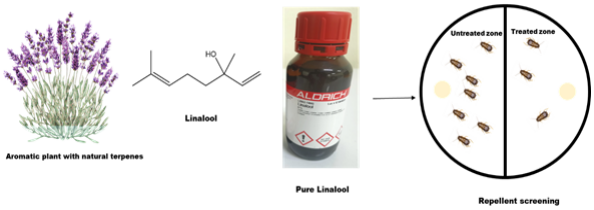

Figure 1: Repellent activity of pure linalool against the early-stage nymph of *P. americana*

Pure linalool (97%) was purchased from Sigma-Aldrich. *In vitro* repellent screening using the choice area preference test (Figure 1). The early nymphal stage of *P. americana* was collected through an insect self-designed aspirator. Dried, sterile 9 cm glass petri plates were divided into halves and marked with Whatman filter paper to indicate the untreated and treated zones. Baits with different concentrations of linalool mixed with acetone (2 µl/mL, 4 µl/mL, 6 µl/mL, 8 µl/mL, and 10 µl/mL) to make 1 mL of volume. 1 ml of acetone served as a control. After complete solvent evaporation, the baits were placed in the petri dishes in both zones. 10 healthy early-stage nymphs were released into the petri dishes. The repellent activity was observed after 20 minutes using the standard formula.

$$\text{Repellent percentage (\%)} = Nc - Nt / Nc + Nt \times 100$$

RESULTS

In vitro repellent screening was significantly influenced by treatment concentrations, as indicated by a One-Way ANOVA ($F(5, 12)) = 69.1$, P 0.001, $R^2 = 0.966$). Tukey's post hoc analysis demonstrated a significant concentration-dependent increase in repellency. The highest repellency was observed at 10 µl/mL, and no significant difference was observed between 6 µl/mL and 8 µl/mL ($P > 0.05$), whereas the control exhibited the lowest repellency. Overall, the repellent activity increased significantly with increasing linalool concentration (Figure 2).

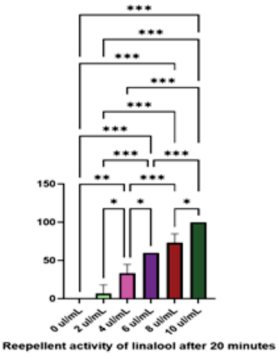

Figure 2. Repellent activity of linalool under laboratory conditions

DISCUSSION

The present work focused on the repellent activity of a natural terpene compound (linalool) against the early-nymphal *stage of P. americana,* and this study is well aligned with the well-documented repellent activity of linalool reported in earlier literature. Linalool showed strong repellent activity against *Aedes aegypti* [7]. Similarly, in another study, linalool exhibited repellency against Ixodes ricinus, with about 50.2% repellency observed [8]. Furthermore, in a recent study, linalool was highly effective at higher doses against the *Culex quinquefasciatus* [9].

CONCLUSION

Linalool exhibited significant, concentration-dependent repellent activity, supporting effectiveness as a bioactive plant-derived compound. The results are consistent with earlier reports describing its repellent properties. Overall, linalool demonstrated strong insecticidal bio-efficacy and can be used as an eco-friendly alternative for urban pest management.

REFERENCES

1. Soonwera, M., Moungthipmalai, T., Takawirapat, W., & Sittichok, S. (2022). Ovicidal

and repellent activities of several plant essential oils against Periplaneta americana L. and enhanced activities from their combined formulation. *Scientific Reports*, *12*(1), 1207.
2. S. Donkor, E. (2019). Nosocomial pathogens: an in-depth analysis of the vectorial potential of cockroaches. *Tropical medicine and infectious disease*, *4*(1), 14.
3. Zahraei-Ramazani, A. R., Saghafipour, A., & Vatandoost, H. (2018). Control of American cockroach (Periplaneta americana) in municipal sewage disposal system, Central Iran. *Journal of Arthropod-Borne Diseases*, *12*(2), 172.
4. Eddleston, M. (2020). Poisoning by pesticides. *Medicine*, *48*(3), 214-217.4.
5. Hummelbrunner, L. A., & Isman, M. B. (2001). Acute, sublethal, antifeedant, and synergistic effects of monoterpenoid essential oil compounds on the tobacco cutworm, Spodoptera litura (Lep., Noctuidae). *Journal of Agricultural and food chemistry*, *49*(2), 715-720.
6. Ling Chang, C., Kyu Cho, I., & Li, Q. X. (2009). Insecticidal activity of basil oil, trans-anethole, estragole, and linalool to adult fruit flies of Ceratitis capitata, Bactrocera dorsalis, and Bactrocera cucurbitae. *Journal of economic entomology*, *102*(1), 203-209.
7. Müller, G. C., Junnila, A., Butler, J., Kravchenko, V. D., Revay, E. E., Weiss, R. W., & Schlein, Y. (2009). Efficacy of the botanical repellents geraniol, linalool, and citronella against mosquitoes. *Journal of Vector Ecology*, *34*(1), 2-8.
8. Tabari, M. A., Youssefi, M. R., Maggi, F., & Benelli, G. (2017). Toxic and repellent activity of selected monoterpenoids (thymol, carvacrol and linalool) against the castor bean tick, Ixodes ricinus (Acari: Ixodidae). *Veterinary parasitology*, *245*, 86-91.
9. Kumar, R., Mittal, P., & Airi, M. (2025). Bioactivity of Linalool Against Culex quinquefasciatus: Repellent and Larvicidal Evaluations. *Archives of Insect Biochemistry and Physiology*, *120*(1), e70098.