DOI: https://doi.org/10.36094/sc.v89.2024.Phytoconstituent_analysis_of_Petroleum.Paramanik.306

ARTICLE

Sci. and Cult. 90 (7–8) : 306-309 (2024)

PHYTOCONSTITUENT ANALYSIS OF PETROLEUM ETHER LEAF EXTRACT OF *OLAX SCANDENS* AND STUDY OF ITS MOSQUITO LARVICIDAL POTENCY

SUDIP PARAMANIK, SAGARIKA MUKHERJEE AND MANAS PARAMANIK *

Plants are abundant reservoirs of phytochemicals, some of which have human-beneficial potential, including vector control. In the current investigation, phytochemical scrutiny of the petroleum ether extract of Olax scandens leaves showed the existence of carbohydrates, phenols, tannins, steroids, and triterpenoids; while FT-IR analysis revealed the existence of –COOH, –CO, and other functional groups. The extract showed Culex quinque fasciatus *larvicidal potency (LC_{50} = 17.84 ppm in 72 hours). So, investigation of this plant may offer several useful phytochemicals.*

Introduction

Phytochemicals, a wide range of compounds found in plants, are vital for their existence and flourishing. They shield plants from herbivores, pathogens, and competing species while also controlling growth processes. The major categories of phytochemicals include polyphenols, terpenoids, alkaloids, sulphur compounds, phytosterols, and phenolic compounds[1]. Phytochemicals are the focus of study in multiple scientific fields, such as pharmacology, biochemistry, and molecular biology. Examining the properties and modes of action of these substances helps in the progress of medicine, agriculture, biotechnology, and the management of vectors and pathogens[2,3].

Mosquitoes transmit malaria, dengue, zika, West Nile virus, and many more[4]. Vector mosquito management by repelling or eliminating them is a novel approach to phytochemical application. It provides a more secure substitute for synthetic insecticides that result in hazards to the environment and non-target organisms[5].

This study investigated the phytoconstituents of the petroleum ether extract (PEE) of *Olax scandens* leaves and the potency of this extract against *Culex quinquefasciatus* larvae, a vector of lymphatic filariasis[6].

Materials and Methods

The current investigation was completed in the Epidemiology, Vector Biology, and Environmental Monitoring Research Unit, Entomology Research Laboratory of the Animal Science Department at Kazi Nazrul University, Asansol.

Preparation of Solvent Leaf Extracts: Fully developed green leaves of *O. Scandens* (Olacaceae) were collected randomly from the Disergarh Roadside of Barakar in West Bengal, India (23°43¹32.1ºN, 86°48¹52.5ºE). Air-dried leaves were ground into dust forms in an electric blender and sieved. Powdered leaves underwent extraction using non-polar to polar solvents in a Soxhlet apparatus. Extracts were condensed using a rotary flash evaporator and kept in air-tight bottles at 4°C until later use[1,7].

* Epidemiology, Vector biology and Environmental monitoring Research Units, Entomology Laboratory, Department of Animal Science, Kazi Nazrul University, Asansol, Paschim Bardhaman, West Bengal, India.

* Corresponding Author's e-mail: manasp74@gmail.com

Phytochemical Screening: The PEE was screened for phytochemicals by applying standard procedures to detect the existence of carbohydrates, proteins, steroids, alkaloids, terpenoids, tannins, and saponins[1,8].

Table 1: Phytochemical screening of the petroleum ether extract of *O. scandens* leaves

Sl. No.	Phytochemical Constituents	Leaf Extract
01	Carbohydrates	+
02	Proteins and Amino acids	-
03	Steroids and Triterpenoids	+
04	Alkaloids	-
05	Flavonoids	-
06	Phenols	+
07	Tannins	+
08	Saponins	-

FT-IR Analysis of the Extract: The effective plant extract was characterized in a Shimadzu Fourier-Transform Infrared spectroscope.

Larvicidal Bioassay: For the experiment, mosquito larvae were obtained from a colony of *Cx. quinquefasciatus* maintained under controlled conditions in laboratory [2,7]. The larvicidal bioassay adhered to World Health Organization (WHO) protocols with minor adjustments[9]. 100 ml solvent extracts of five grades (50 ppm to 250 ppm) were taken in glass bowls (maintained under standard conditions), each containing twenty-five 3rd instar larvae[2]. Each experiment includes four replicates and a control group with only distilled water. Death was noted at 24-, 48-, and 72-hours after exposure.

Toxicity on Non-target Organisms: The harmfulness of PEE was tested on the non-target organism, chironomid larvae, which coexist in a similar habitat as *Cx. quinquefasciatus* larvae [5].

Statistical Analysis: Percentage mortalities were determined for each concentration after 24, 48, and 72 hours of exposure. Lethal concentrations were calculated by probit analysis with a 95% confidence level[2,10].

Result

Phytochemical Screening: The phytochemical analysis of PEE of *O. scandens*, as presented in Table 1, identified the existence of diverse compounds such as carbohydrates, triterpenoids, tannins, steroids, and phenols.

FT-IR Analysis: Different types of characteristic absorption bands can be found at 3380.25 cm^{-1}, which shows N-H, C-H, O-H, and the stretching of amines and amides; 2954.18 cm^{-1} for carboxyl acid; 2924.46 cm^{-1} for C-H stretching; 2854.32 cm^{-1} for carboxyl acid; 1725.70 cm”1 for ketones; 1457.27 cm^{-1} for alkanes; 1261.49 cm^{-1} for alkyl ketone; 1166.19 cm^{-1} for alkyl amine; 1042.08 cm^{-1} for polysaccharide; and 771.93 cm^{-1} for halogen compounds (Fig. 1).

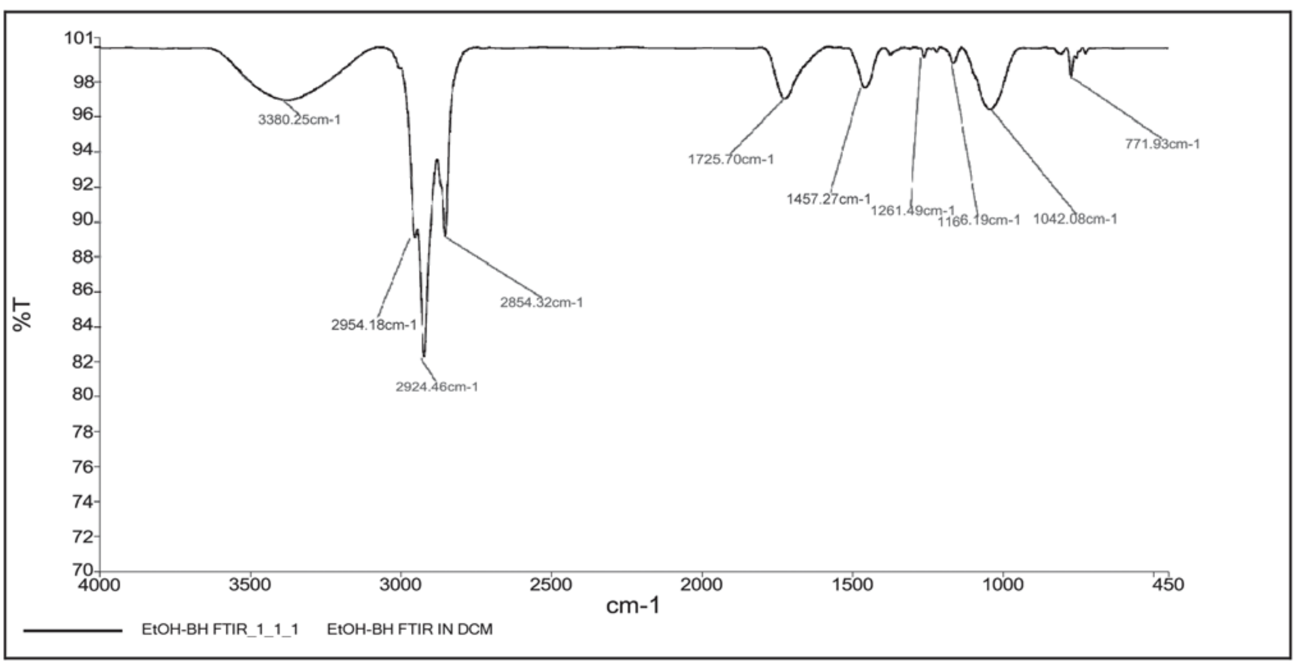

Fig. 1: FT-IR spectrum of the petroleum ether extract of *O. scandens* leaves

Larvicidal Potency: The extract applied on 3rd instar larvae of *Cx. quinquefasciatus* demonstrated significant larvicidal activities. The maximum effectiveness was detected in 72 hours with the LC_{50} value of 17.84 ppm, which represents the concentration at which 50% mortality occurred (Table 2). 100% death was detected in 250 ppm concentrations after 48 hours and 150 ppm and 200 ppm concentrations after 72 hours post-exposure (Fig. 2). The extract shows no significant consequence on the non-target animals.

Table 2: Probit and regression analysis of mortalities with petroleum ether extract of *O. scandens* leaves against the 3rd instar larvae of *Cx. quinquefasciatus*

Time of Exposure	LC_{50} Value (ppm)	LC_{90} Value (ppm)	Regression Equation	R^2 Value
24 h	144.24	440.49	Y= 2.64X+(-0.7)	0.885
48 h	50.82	167.67	Y= 2.469x+0.7878	0.708
72 h	17.84	69.17	Y = 2.1754x+2.2774	0.890

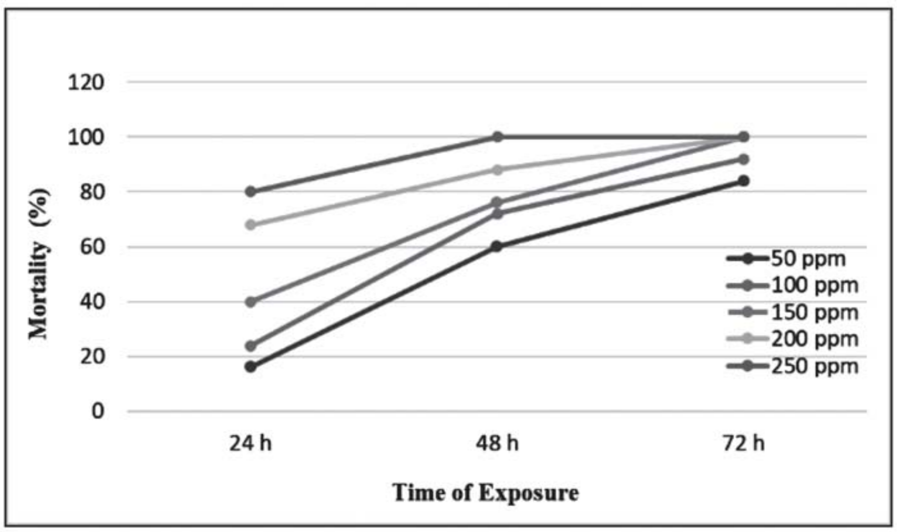

Fig. 2: Mortality of 3rd instar larvae of *Cx. quinquefasciatus* to different concentrations of petroleum ether extract of *O. scandens* leaves

Discussion

Plants synthesize several secondary metabolites, that hold properties that are beneficial to mankind in the fields of medicine, agriculture, industry, as well as vector and pest management. Experiments exhibited that phenolic acids are anti-infective, anti-oxidant, contraceptive agents, and free radical scavengers; terpenes have anti-cancer and anti-oxidant agents[11]. Certain phytochemicals derived from the Olacaceae plant family have been scientifically recorded to possess anti-inflammatory, anti-diabetic, anti-obesity, anti-cancer, immunosuppressive, and neuroprotective effects, with mosquito larvicidal properties [12,13]. In this study, several phytoconstituents were found in the PEE of *O. scandens* leaves, which have many useful properties. These phytochemicals also demonstrated promising mosquito larvicidal potency.

Conclusion

The detrimental effects of synthetic chemicals and pollutants on biodiversity and human health bring more and more focus to the use of biologically safe phytochemicals in different fields. Exploration of the phytoconstituents of various parts of plants and their bioactivity becomes the need of the time. This study indicates that the PEE of *O. scandens* leaves possesses several useful phytochemicals. Mosquito-borne diseases cause millions of deaths annually and burden countries. Killing mosquitoes in their aquatic breeding habitats is one of the easiest ways to manage vectors[14]. However, many aquatic bodies are already severely polluted [15] and the application of more synthetic insecticides for killing mosquito larvae is not recommended. Therefore, as a part of sustainable vector control strategies, the focus is on managing mosquitoes using relatively innocuous practices to non-target organisms and posing minimal risks to users and consumers, such as the application of plant-based insecticides. The study examines *O. scandens*, a readily accessible, inexpensive plant. Bioactive compounds extracted from the leaf show superior efficacy in reducing mosquito threats, promising as an environmentally friendly, bio-based substitute for synthetic agents. ❐

References

1. J.B. Harborne, Phytochemical methods: A Guide to Modern Techniques of Plant Analysis. (Chapman and Hall, London, 1984) p. 1-278.
2. M. Paramanik, S.K. Chatterjee, and G. Chandra, *Int. J. Mosq. Res.*, **10**(1), 01-06 (2023).
3. N. Chowdhury, M. Paramanik, N. Sarkar, S. Laskar, and G. Chandra, *Anal. Chem. Lett.* **5**(5), 260-266 (2015).
4. M. Paramanik, *Int. J. Entomol. Res.*, **8**(1), 70-75 (2023).

5. M. Paramanik, S. Paramanik, S. Mukherjee, R. Kapuri, and S. Dasmodak, *Int. J. Mosq. Res*., **9**(2), 26-29 (2022).

6. M. Paramanik, and G. Chandra, *Asian Pac. J. Trop. Med.***3** (9), 727-730 (2010).

7. C. Kamaraj, A. Bagavan, A.A. Rahuman, A.A. Zahir, G. Elango, and G. Pandiyan, *Parasitol. Res.*, **104**, 1163-1171 (2009).

8. N. Kancherla, A. Dhakshinamoothi, K. Chitra, and R.B. Komaram, *Maedica.*, **14**(4), 350-356 (2019).

9. WHO. Guidelines for laboratory and field testing of mosquito larvicides. WHO: Geneva WHO/CDS/WHOPES/GCDP/13, 1-41 (2005).

10. D.J. Finney, Probit Analysis. (Cambridge University Press, Cambridge, 1971) p. 1-333.

11. J.R.S. Rex, N.M.S.A. Muthukumar, and P.M. Selvakumar, *MOJ Biorg. Org. Chem*., **2**(2), 61-70 (2018).

12. Y.L. Huang, M.B. Oppong, Y. Guo, L.Z. Wang, S.M. Fang, Y.R. Deng, and X.M. Gao, *Fitoterapia.*, **136**, 104155 (2019)

13. S. Paramanik, S. Mukherjee, R. Kapuri, S. Dasmodak, and M. Paramanik, *Int. J. Mosq. Res*., **9**(6), 27-32 (2022).

14. M. Paramanik, I. Bhattacharjee, and G. Chandra, *Asian Pac. J. Trop. Biomed.*, **2**(3s), s1869-s1873 (2012).

15. S. Mukherjee and M. Paramanik, *Intern. J. Zool. Invest*., **8(1)**, 152-161 (2022).