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OVIPOSITION DETERRENT ACTIVITY OF CASSAVA PLANT *Manihot esculenta* EXTRACTS AGAINST *Culex quinquefasciatus*

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Abstract

Background:

Biological control methods for mosquitoes include using natural predators, parasites, or pathogens. This has encouraged researchers to find cost-effective, eco-friendly, and low-toxicity options for controlling mosquito larvae.

Materials and Method

Gravid females of Cx. quinquefasciatus were placed in colony cages with 100 mosquitoes each. Enamel bowls with cesspit water and varying concentrations of Cassava extract were used to record egg rafts laid, with controls including methanol. Bowls were moved to avoid position effects, and each set was repeated six times. The number of eggs laid was counted afterward.

Result and Discussion:

The study tested different concentrations of ethanolic leaf extract from M. esculenta on cesspit water to attract mosquito oviposition. The highest number of egg rafts was observed at 200 ppm with 84. 5 rafts, while 40 ppm had the lowest at 39. 8. Higher concentrations resulted in increased attractancy . At 200 ppm, the effective attractancy was 95. 15%. The extract showed potential for controlling Cx. quinquefasciatus by inhibiting egg development and growth.

Conclusion:

The highest number of 84.5 egg rafts was found at a concentration of 200 ppm

Keywords: Biological control, *M. esculenta*, egg rafts, Insecticide, leaf extract

1. Introduction

The use of biological control method is to use natural enemies or predators for managing mosquito populations. Several types of biological control are implemented over the years such as the direct introduction of parasites or pathogens or predators for the target mosquito species. Thus, the Environmental Protection Act in 1969 has framed a number of rules and regulations to check the application of chemical control agents in the environment (Bhatt and Khanal, 2009). It has prompted researchers to look for the least cost, environmentally friendly and least-toxic larval control and mosquitocidal agents. A large number of medicinal plants have been reported to have mosquito repellent and larvicidal activities, but only a few numbers of plants are being utilized *in situ* for mosquito control.

Collection and Extraction of Plant material:

The Cassava plant *(M.esculenta*) was collected near Chidambaram from C. Mutlur during the harvesting stages of the plant. The leaves were washed and dried. The plant leaves (3.0 kg) were extracted with ethanol in a Soxhlet apparatus, and the extract was evaporated in a rotary vacuum evaporator to yield a dark greenish coloured mass. A standard stock solution of 1% was prepared by dissolving the residues in ethanol.

Culture of Mosquitoes:

The mosquito, *Cx. quinquefasciatus*, was reared in the Vector Control Laboratory at the Department of Zoology, Annamalai University. The adults were provided with 10% sucrose solution and one week old chick for blood meal. Mosquitoes were held at (28±2)□, 70%-80% relative humidity (RH), with a photoperiod of 14 h light, 10 h dark.

Materials and Method

The gravid female of *Cx. quinquefasciatus* were introduced into the colony cages in numbers of 100 mosquitoes density. Enamel bowls containing 250 ml of cesspit water with different concentrations of (40, 80, 120, 160 and 200 ppm) ethanolic extract of Cassava in different cages and bowl with cesspit water and38 methanol served as a control. The number of egg rafts laid in treated and control bowls was recorded. The positions of bowls were interchanged during different replicates so as to nullify any effect of position on oviposition. Each experimental sets were replicated six times. Sucrose solution (10%) was provided to the adult as feed throughout the study period. Experiments were carried out at room temperature for a period of 72 hours. After the 72 hours, the number of eggs that were laid in each bowl was counted and recorded. The percent effective repellency (ER) for each concentration was calculated using the following formula:

$$\text{Percentage of Effective repellency (EA)} = \frac{\text{NT - NC}}{\text{NT}} \times 100$$

Where

NC = Number of egg raft in the control,

NT = Number of eggs in the treatment

Result And Discussion

The cesspit water was treated with different concentrations of ethanolic leaf extract of *M. esculenta* viz. 40, 80, 120, 160, 200 ppm. The egg rafts of 39.8, 50.0, 62.2, 72.1 and 84.5 were noticed at 40, 80, 120, 160, 200 ppm concentration of plant extract. The highest number of 84.5 egg rafts was found to be at a concentration of 200 ppm while the lowest number of 39.8 egg rafts was represented at 40 ppm concentration. The control showed a low level of egg rafts when compared to plant extract treatment. The highest effective attractancy of 95.15 per cent was observed at 200 ppm plant extract concentration, and the lowest effective attractancy of 48.74 per cent was observed at 40 ppm plant extract concentration. The 50 per cent oviposition attractancy concentration was noticed at 77.71 ppm plant extract concentration. The treated group showed an increased number of egg rafts when the concentration of plant extract increased.

In the present study, *M. esculenta* ethanolic extract showed *a* novel activity of mosquito oviposition attractancy against *Cx. quinquefasciatus.* The highest number of 84.5 per cent egg rafts was found to be at a concentration of 200 ppm. Ovicidal compounds can interrupt embryonic development and impair the survival of the larvae inside the egg. In view of recently increased interest in developing plant-based insecticides that can be used as an alternative to the commercially available chemical insecticides, the current study was undertaken to assess the ovicidal potential of *M. esculenta* ethanolic leaf extract against the medically important mosquito vector *Cx. quinquefasciatus*. In the present study, all concentrations of the extract showed good ovicidal activity, and maximum ovicidal activity was exhibited at 200 ppm of ethanol leaf extract of *M. esculenta*, which provided to have excellent potential for controlling the vector mosquito, *Cx. quinquefasciatus.* The 50 per cent oviposition attractancy concentration was noticed at 77.71 ppm concentration. The *M. esculenta* extract may be responsible for retarding the growth of eggs by inhibiting the embryogenesis.

Conclusion:

The highest number of 84.5 egg rafts was found at a concentration of 200 ppm of *M. esculenta* extract, and the zero hatchability (100% mortality) was noted at a concentration of 250 and 300 ppm of *M. esculenta* extract.

Table

Oviposition attractancy of *M. esculenta* plant extract against *Cx. Quiquefasciatus*

Table 4.3 Oviposition attractancy of *M. esculenta* plant extract against *Cx. quiquefasciatus*

Concentration (ppm)	No.of egg raft		Effective attractancy (%)	OAC_{50} (ppm)	OAI
	Treated	Control			
40	39.8 ± 2.99^{a}	20.4	48.74 ± 3.72^{a}	77.71	0.32 ± 0.02^{a}
80	50.0 ± 3.81^{b}	16.6	66.80 ± 5.20^{b}		0.50 ± 0.04^{b}
120	62.2 ± 4.76^{c}	10.5	83.11 ± 6.35^{c}		0.71 ± 0.05^{c}
160	72.1 ± 5.49^{d}	6.6	90.85 ± 6.92^{d}		0.83 ± 0.06^{d}
200	84.5 ± 6.44^{e}	4.1	95.15 ± 7.20^{d}		0.90 ± 0.07^{d}

Significant at $p<0.05$; OAI: Oviposition Active Index; OAC: Oviposition Attractancy Concentration.

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