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Short Communication

Mosquito Larvicidal Properties of Essential Oil of an Indigenous Plant, *Ipomoea cairica* Linn.

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SUMMARY: Laboratory bioassay of the essential oil extracted from an indigenous plant, *Ipomoea cairica*, commonly known as 'Railway creeper', was carried out against the larvae of four vector species of mosquitoes in order to evaluate its mosquito larvicidal effect. Bioassay test revealed that the essential oil of the plant possess remarkable larvicidal properties as it could induce 100% mortality in the larvae of *Culex tritaeniorhynchus* (100 ppm), *Aedes aegypti* (120 ppm), *Anopheles stephensi* (120 ppm), and *Culex quinquefasciatus* (170 ppm) mosquitoes at concentrations ranging from 100 to 170 ppm. The LC_{50} and LC_{90} values estimated for *Cx. tritaeniorhynchus*, *Ae. aegypti*, *An. stephensi*, and *Cx. quinquefasciatus* were 14.8 and 78.3, 22.3 and 92.7, 14.9 and 109.9, and 58.9 and 161.6 ppm, respectively. The essential oil was found to be most highly toxic to the larvae of *Cx. tritaeniorhynchus* followed by *Ae. aegypti*, *An. stephensi*, and *Cx. quinquefasciatus* mosquitoes.

Over the last 5 decades the indiscriminate use of synthetic insecticides in agriculture and public health programs for the control of pest species has created multifarious problems viz. insecticide resistance, environmental pollution, toxic hazards to humans and other non-target organisms. In attempt to overcome these problems, great emphasis has been recently placed on the research and development of forms of pest control using natural plant products. Studies on natural plant products as larvicides have indicated that they could provide possible alternatives to synthetic chemical insecticides (1).

The present communication deals with laboratory studies carried out to evaluate the larvicidal efficacy of essential oil extracted from an indigenous plant, *Ipomoea cairica* Linn. (Family: Convolvulaceae). This plant is commonly known as "Railway creeper", and being ornamental in nature it is widely used in fencing in domestic and peri-domestic situations. The medicinal properties of this plant have been reported in which a drink made of the plant's crushed leaves is used for the treatment of body rashes, especially those accompanied by fever (2). However, there have been no reports regarding the plant's mosquito larvicidal properties.

The plant material was collected from the National Zoological Park, Delhi, and its adjoining areas. The freshly collected plant materials were washed thoroughly, chopped off finely, and subjected to hydro-distillation in Clevenger's apparatus in order to obtain its vaporizing essential oil. The oil is light yellow in color, no odor and with medium viscosity. The oil yield of the plant ranged from 1.5 - 2.0 ml/kg wet weight of the plant material. The oil thus obtained was stored in plastic tubes under refrigeration till its later use. The insecticidal properties of the essential oil was evaluated under laboratory conditions against the larvae of four vector mosquito species viz. *Culex tritaeniorhynchus*, vector of Japanese encephalitis, *Aedes aegypti*, vector of dengue fever, *Anopheles stephensi*, vector of malaria, and *Culex quinquefasciatus*, vector of lymphatic filariasis. The larval bioassay tests were carried out by following the standard World Health Organization larval susceptibility test method (3). The oil was first dissolved in acetone at a ratio of 1:1 of acetone and oil. A series of concentrations ranging from 5 to 200 ppm of the dissolved oil was prepared in water. Four replicates were run for each concentration and species of mosquito larvae. Control tests were carried out in parallel with the required amount of acetone in water.

Mortality counts were made after 24 h of exposure. Bioassay test showing more than 20% control mortality were discarded and repeated. However, when control mortality ranged from 5 - 20%, the corrected mortality was calculated using Abbot's formula (3).

Laboratory bioassay tests were carried out using the essential oil against the laboratory-reared (Delhi strain) larvae of four vector species of mosquitoes. The test revealed that at concentrations of 100, 120, 120, and 170 ppm of essential oil could induce 100% mortality in the larvae of *Cx. tritaeniorhynchus*, *Ae. aegypti*, *An. stephensi*, and *Cx. quinquefasciatus* mosquitoes, respectively. The data obtained were subjected to probit analysis in order to estimate the LC_{50}, LC_{90} and heterogeneity values (4). The LC_{50} and LC_{90} values estimated for *Cx. tritaeniorhynchus*, *Ae. aegypti*, *An. stephensi*, and *Cx. quinquefasciatus* were 14.8 and 78.3, 22.3 and 92.7, 14.9 and 109.9, and 58.9 and 161.6 ppm, respectively. Heterogeneity values calculated for *Cx. tritaeniorhynchus*, *Ae. aegypti*, *An. stephensi*, and *Cx. quinquefasciatus* were 21.6, 27.6, 30.5, and 44.3 respectively. The essential oil was found to be relatively more toxic to the larvae of *Cx. tritaeniorhynchus* (2.1-fold) followed by *Ae. aegypti* (1.7-fold) and *An. stephensi* (1.5-fold) when compared with the larvae of *Cx. quinquefasciatus* (1.0) (Table 1).

Earlier studies involving the essential oils obtained from various plants viz. *Cymbopogon nards*, *C. flexuosus*, *C. martinii*, *Lavadula officinalis*, *Mentha arvensis*, *Racinus communis*, *Eucalyptus globulus*, *Eugenia caryophyllus*, *Ocimum basilicum*, *Melia azardirachta*, and *Cannabis sativa* recorded LC_{50} values of 105.4, 91.4, 100.0, 83.6, 83.8, 113.0, 98.5, 96.5, 80.0, 88.5, and 27.0 ppm, respectively, against the larvae of the *An. stephensi* mosquito (5-8). However, the present study revealed that the essential oil obtained from the *Ipomoea cairica* plant could induce 50%

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Table 1. Dosage response of essential oil of *Ipomoea cairica* plant against the larvae of four vector species of mosquitoes

Mosquito species	LC_{50} values (ppm)	LC_{90} values (ppm)	Heterogeneity χ^2 (df)*	Relative toxicity
Culex tritaeniorhynchus	14.8 (14.6 - 14.8)	78.3	21.6(4)	2.1
Aedes aegypti	22.3 (22.0 - 22.5)	92.7	27.6(5)	1.7
Anopheles stephensi	14.9 (14.6 - 15.8)	109.9	30.5(5)	1.5
Culex quinquefasciatus	58.9 (58.0 - 59.2)	161.6	44.3(4)	1.0

ppm: parts per million, LC_{50}: Lethal concentration required to kill 50% of the population exposed, LC_{90}: Lethal concentration required to kill 90% of the population exposed, *df: degrees of freedom, χ^2: Chi-square for heterogeneity.

mortality in the larvae of *An. stephensi* at a very low concentration of 14.9 ppm, which is 2 to 7.6 times lower than those of the plants studied earlier.

This study indicates that the essential oil of *Ipomoea cairica* has remarkable larvicidal properties and its use as larvicide against mosquitoes should be explored, as this plant grows abundantly in the wild. It is worthwhile to study extensively the larvicidal properties of the plant's essential oil by isolating and identifying the active components that cause larval mortality and then use them in field trials in order to asses their potential as an alternative to chemical larvicides.

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